

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHURE INCORPORATED,
Petitioner,

v.

CLEARONE, INC.,
Patent Owner.

PGR2020-00079
Patent 10,728,653 B2

Before JONI Y. CHANG, KALYAN K. DESHPANDE,
and DAVID C. McKONE, *Administrative Patent Judges*.

McKONE, *Administrative Patent Judge*.

JUDGMENT

Final Written Decision

Determining No Challenged Claims Unpatentable

35 U.S.C. § 328(a)

Dismissing Patent Owner's Revised Contingent Motion to Amend

37 U.S.C. § 326(d)

Dismissing Patent Owner's Motion to Exclude

37 C.F.R. § 42.64(c)

I. INTRODUCTION

A. Background and Summary

Shure Inc. (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting post-grant review (“PGR”) of claims 1–24 of U.S. Patent No. 10,728,653 B2 (Ex. 1001, “the ’653 patent”). Pet. 1. ClearOne, Inc. (“Patent Owner”) filed a Preliminary Response (Paper 10, “Prelim. Resp.”). Pursuant to 35 U.S.C. § 324, we instituted this proceeding. Paper 14 (“Dec.”).

Patent Owner filed a Patent Owner’s Response (Paper 27, “PO Resp.”), Petitioner filed a Reply to the Patent Owner’s Response (Paper 30, “Reply”), and Patent Owner filed a Sur-reply to the Reply (Paper 39, “Sur-reply”).

Additionally, Patent Owner filed a Contingent Motion to Amend (Paper 25) and sought preliminary guidance; Petitioner responded to the Motion to Amend (Paper 31); we issued Preliminary Guidance (Paper 35); Patent Owner filed a Revised Contingent Motion to Amend (Paper 37); Petitioner responded to the Revised Contingent Motion to Amend (Paper 42); and Patent Owner replied to Petitioner’s response (Paper 49).

Additionally, Patent Owner filed a Motion to Exclude (Paper 50, “Mot. to Exclude”); Petitioner responded to the Motion to Exclude (Paper 51); and Patent Owner replied to Petitioner’s response (Paper 52).

An oral argument was held in this proceeding on December 14, 2021. Paper 58 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Decision is a final written decision under 35 U.S.C. § 328(a) as to the patentability of claims 1–24. Based on the record before us, Petitioner not has proved, by a preponderance of the evidence, that claims 1–24 are unpatentable. We

dismiss as moot Patent Owner's Revised Contingent Motion to Amend and Motion to Exclude.

B. Related Matters

The parties state that the patent to which the '653 patent claims priority (U.S. Pat. No. 9,813,806 ("the '806 patent")) is asserted in *Shure Inc. v. ClearOne, Inc.*, No. 1:17-cv-03078 (N.D. Ill.) ("the Illinois case"). Pet. 101; Paper 4, 2. Patent Owner identifies *ClearOne, Inc. v. Shure Acquisition Holdings, Inc.*, IPR2019-00683, challenging Petitioner's U.S. Patent No. 9,565,493, as relevant to this proceeding. Paper 4, 2–3.

C. The '653 Patent

The '653 patent, which issued from U.S. Patent Application No. 15/218,297 ("the '297 application"), relates to "beamforming microphone array systems with support for interior design elements," and describes embodiments "in the form of a ceiling tile (with or without sound absorbing material), light fixtures, or wall panels (with or without sound absorbing materials), and acoustic wall panels." Ex. 1001, 1:27–30, 1:66–2:2. According to the Specification, "[a] 'beamforming microphone' . . . may refer to one or more omnidirectional microphones coupled together that are used with a digital signal processing algorithm to form a directional pickup pattern that could be different from the directional pickup pattern of any individual omnidirectional microphone in the array." *Id.* at 4:60–67. Figure 1A, reproduced below, illustrates an example:

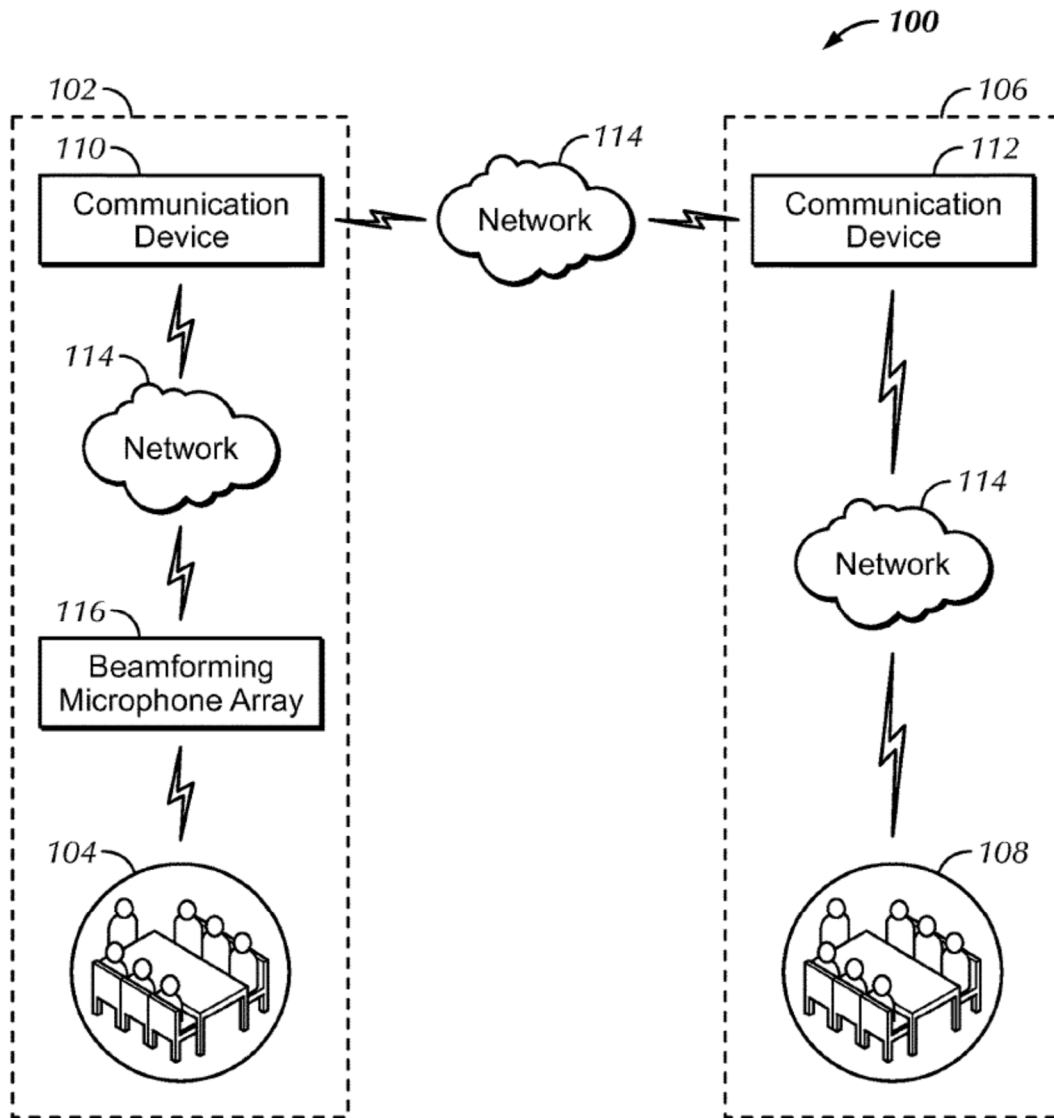


FIG. 1A

Figure 1A is a schematic of an environment for implementing a beamforming microphone array. *Id.* at 3:10–13, 5:12–15.

First environment 100 includes first location 102, with first set of users 104, communicating with second location 106, with second set of users 108, over network 114 via communication devices 110, 112. *Id.* at 5:19–25. First environment 100 includes beamforming microphone array 116, which “may include multiple microphones for converting ambient sounds (such as voices or other sounds) from various sound sources (such as the first set of

users 104) at the first location 102 into audio input signals.” *Id.* at 5:61–64. Array 116 may include acoustic echo cancellation (AEC), *id.* at 6:5–6, adjustable noise cancellation, *id.* at 6:18–22, and other signal processing technology. According to the Specification, “another embodiment of Array 116 may include adaptive acoustic processing that automatically adjusts to the room configuration for the best possible audio pickup.” *Id.* at 6:13–16.

The Specification states that “[t]he Array 116 may be configured and arranged into various usage configurations, such as ceiling mounted, drop-ceiling mounted, wall mounted, etc.” *Id.* at 7:51–54, Figs. 2A–2J. For example, “the Array 116 with BFMs [beamforming microphones] 212 and the NBFMs [non-beamforming microphones] may be combined to a ceiling tile for a drop ceiling mounting configuration 260.” *Id.* at 9:38–40, Figs. 2F–2I. Figure 2F, reproduced below, is illustrative:

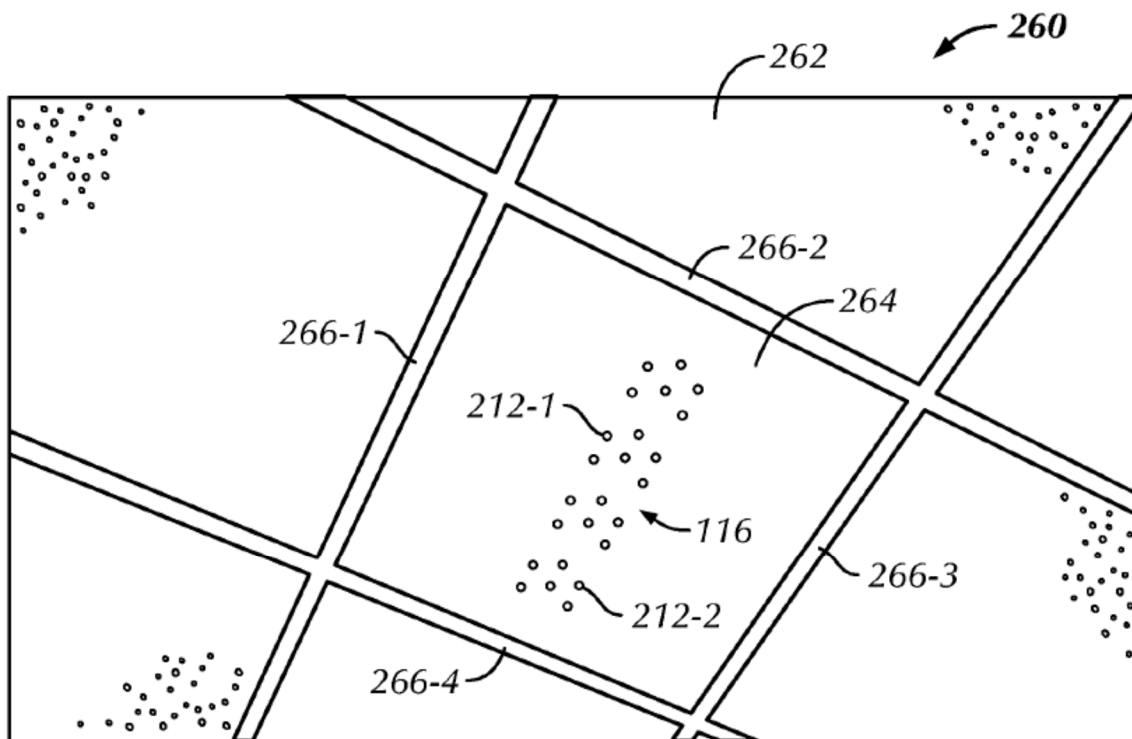


FIG. 2F

Fig. 2F is a picture of drop-ceiling tiles with microphones. *Id.*

“The drop ceiling 262 may be created using multiple drop ceiling tiles, such as a ceiling tile 264, each arranged in a pattern based on (1) a grid design created by multiple support beams 266-1, 266-2, 266-3, 266-4 (collectively, support beams 266) connected together in a predefined manner and (2) the frame configuration of the support beams 266.” *Id.* at 9:43–49.

“[C]eiling tile 264 may be made of a variety of materials or combinations of materials including, but not limited to, metals, alloys, ceramic, fiberboards, fiberglass, plastics, polyurethane, vinyl, or any suitable acoustically neutral or transparent material known in the art, related art, or developed later.”

Id. at 9:60–66.

Claim 1, reproduced below, is illustrative of the invention:

1. A ceiling tile microphone, comprising:

a beamforming microphone array that includes
beamforming and acoustic echo cancellation, a plurality of microphones of the beamforming microphone array are positioned at predetermined locations, the beamforming microphone array picks up audio input signals, the beamforming microphone array includes adaptive acoustic processing that automatically adjusts to a room configuration;

a ceiling tile combined with the beamforming microphone array, the ceiling tile being sized and shaped to be mountable in a drop ceiling in place of at least one of a plurality of ceiling tiles included in the drop ceiling;

where an outer surface of the ceiling tile is acoustically transparent.

D. Evidence

Petitioner relies on the references listed below.

| Reference(s) | | Date | Exhibit No. |
|-------------------------|--|---------------|-------------|
| Graham | US 2015/0078582 A1 | Mar. 19, 2015 | 1010 |
| Levit | US 2009/0173570 A1 | July 9, 2009 | 1016 |
| Beaucoup | US 2003/0118200 A1 | June 26, 2003 | 1017 |
| CTG System ¹ | Declaration of David Newman | July 23, 2020 | 1009 |
| | CTG Audio Installation & Operation Manual (“CTG Manual”) | May 6, 2009 | 1011 |
| | Fullsound Ceiling Microphone CTG CM-01 (“CM-01 Sell Sheet”) | | 1012 |
| | Fullsound CTG FS-400 and FS-800 with “Beamforming” Technology (“FS-400/800 Sell Sheet”) | | 1013 |
| | CTG Audio White Paper, <i>Meeting the Demand for Ceiling Mics in the Enterprise, 5 Best Practices</i> (“CTG White Paper”) | 2012 | 1014 |
| | CTG Audio Frequently Asked Questions, available at https://web.archive.org/web/20110123043003/http://www.ctgaudio.com/faq.htm (“CTG FAQ”) | Jan. 23, 2011 | 1015 |

¹ In its statement of grounds, Petitioner contends that Exhibits 1009, 1011–1015, and 1025–1028 describe CTG System. Pet. 17. For completeness, we list all of Petitioner’s identified documents here. Nevertheless, Petitioner’s detailed analysis discusses only Exhibits 1009 and 1011–1015. *Id.* at 65–86, 88–100.

| Reference(s) | | Date | Exhibit No. |
|--------------|--|-----------|-------------|
| | CTG Audio Brochure, CTG Conferencing Systems, as discreet as they are exceptional | | 1025 |
| | Soundman SM-02 Installation Manual and User Guidelines | | 1026 |
| | CTG Audio, Introducing the CTG FS-400 and FS-800 With “Beamforming” Technology | 2008 | 1027 |
| | Scanlines webpage, Vol. 7, Issue 2, available at http://www.enrightcompany.com/SCANLINESARCHIVES/2009-06/ScanlinesJun09.htm | June 2009 | 1028 |

Petitioner also relies on the Declaration of Jeffrey S. Vipperman, Ph.D. (Ex. 1002), the Second Declaration of Dr. Vipperman (Ex. 1029), and the Third Declaration of Dr. Vipperman in support of the Opposition to the Revised Contingent Motion to Amend (Ex. 1039).

Patent Owner relies on the Declaration of Durand R. Begault, Ph.D. (Ex. 2013), the Second Declaration of Dr. Begault in support of the Motion to Amend (Ex. 2014), and the Third Declaration of Dr. Begault in support of the Motion to Amend Reply (Ex. 2038).

E. Asserted Grounds

We instituted on the following grounds of unpatentability (Dec. 8):

| Ground | Claims Challenged | 35 U.S.C. § | Reference(s)/Basis |
|--------|-------------------|---------------------|---------------------------------|
| 1 | 1–24 | 112(b) ² | Indefiniteness |
| 2 | 1–24 | 112(a) | Enablement |
| 3 | 1–24 | 112(a) | Written Description |
| 4 | 1–24 | 112(a), 132(a) | Written Description, New Matter |
| 5 | 1–24 | 103 | Graham, Levit |
| 6 | 1–24 | 103 | CTG System, Levit |
| 7 | 1–24 | 103 | CTG System, Beacoup, Levit |

II. ANALYSIS

A. Level of Ordinary Skill in the Art

Petitioner contends that a skilled artisan “would have possessed at least: (i) a bachelor’s degree in mechanical engineering, electrical engineering, physics, or acoustical engineering that included coursework on the design of acoustic and/or antenna arrays, phased arrays, and/or beamforming; or (ii) at least three years of work experience in the field of directional microphone arrays.” Pet. 18 (citing Ex. 1002 ¶¶ 18–20).

Patent Owner argues that Petitioner’s inclusion of “at least” introduces vagueness. PO Resp. 15–16. Patent Owner further argues that a skilled artisan would have had experience with digital signal processing.

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88, 296–97 (2011), amended 35 U.S.C. §§ 103 and 112. In the Institution Decision, we determined that the challenged claims of the ’653 patent do not have effective filing dates earlier than September 16, 2012, or March 16, 2013, the effective dates of the relevant amendments. Dec. 9–11. Thus, the post-AIA versions of §§ 103 and 112 apply.

Id. at 16 (citing Ex. 2008 (Preliminary Injunction Order in the Illinois case), 11). Although Patent Owner does not explain the relevance here of a district court decision relating to a different patent, Petitioner does not contest this proposed addition. Patent Owner does not contest any other aspects of Petitioner’s proposal. Neither party contends that the differences in their respective proposals impacts any issues the parties ask us to resolve.

As we stated in the Institution Decision (at 30), Petitioner’s proposal is reasonable in light of the descriptions in the ’653 patent and prior art, and is supported by expert testimony. We further find that Patent Owner’s proposed addition, that a skilled artisan would have had experience with digital signal processing, is consistent with the descriptions in the ’653 patent and prior art. Because the parties do not contend that their disagreement over “at least” has any bearing on this proceeding, we need not evaluate whether a skilled artisan might have had more than three years of work experience or whether that would lead to vagueness. Instead, we adopt Petitioner’s proposal, with Patent Owner’s addition, and omit “at least”: A skilled artisan would have possessed: (i) a bachelor’s degree in mechanical engineering, electrical engineering, physics, or acoustical engineering that included coursework on the design of acoustic and/or antenna arrays, phased arrays, and/or beamforming; or (ii) three years of work experience in the field of directional microphone arrays; and the skilled artisan would have had experience with digital signal processing.

B. Claim Construction

We construe a claim

using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b),

including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

37 C.F.R. § 42.200(b) (2019); *see also Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

At the institution stage of the proceeding, the parties disputed the constructions of “a ceiling tile,” “beamforming microphone array,” “an outer surface of the ceiling tile is acoustically transparent,” and “adaptive acoustic processing that automatically adjusts to a room configuration,” as recited in claim 1.

We preliminarily construed “an outer surface of the ceiling tile is acoustically transparent” to have its ordinary meaning, in accordance with Patent Owner’s proposal and, specifically, we rejected Petitioner’s arguments that the outer surface of a ceiling tile must be distinct from the core of the ceiling tile. Dec. 35–37. Patent Owner argues in favor of our preliminary construction. PO Resp. 19–23. Petitioner does not dispute the construction of this limitation further in the Reply, and we maintain our construction for the reasons given in the Institution Decision.

We preliminarily construed “a ceiling tile” to mean “one or more ceiling tiles.” Dec. 31–35. The parties continue to dispute the construction of this term, and we address it below.

We did not find it necessary to construe “beamforming microphone array.” *Id.* at 31. The parties continue to dispute the construction of this term, however, and we address it below.

We addressed the parties’ construction of “adaptive acoustic processing that automatically adjusts to a room configuration” in our analysis of Petitioner’s indefiniteness allegations. *Id.* at 31, 38–44. We

further consider the parties' claim construction arguments as to this term in addressing Petitioner's indefiniteness ground below.

Based on the record before us, we do not find it necessary to provide express claim constructions for any other terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (noting that "we need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

1. "a ceiling tile"

Claim 1 recites "a ceiling tile combined with the beamforming microphone array, the ceiling tile being sized and shaped to be mountable in a drop ceiling in place of at least one of a plurality of ceiling tiles included in the drop ceiling." Claims 9 and 17 include similar recitations. Petitioner contends that "a ceiling tile" should be construed as "one or more ceiling tiles." Pet. 19. Patent Owner argues that it "should be construed to mean a single ceiling tile." PO Resp. 24. In the Institution Decision, we followed the "general rule" that "a" or "an" in a patent claim means "one or more." Dec. 31–32 (quoting *01 Communique Lab., Inc. v. LogMeIn, Inc.*, 687 F.3d 1292, 1297 (Fed. Cir. 2012) ("The exceptions to this rule are extremely limited: a patentee must evince a clear intent to limit 'a' or 'an' to 'one.' . . . An exception to the general rule arises only 'where the language of the claims themselves, the specification, or the prosecution history necessitate a departure from the rule.'" (quoting *Baldwin Graphic Sys., Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1342 (Fed. Cir. 2008)))).

Patent Owner argues that this rule "potentially applies only when the article 'a' (or 'an') precedes an item in an open-ended list" and "derives

from the open-ended transition phrase (*e.g.*, comprising).” PO Resp. 25 (citing *Scanner Techs. Corp. v. ICOS Vision Sys. Corp.*, 365 F.3d 1299, 1305–06 (Fed. Cir. 2004)). In contrast, Patent Owner continues, “if the claim recites ‘a widget with properties A, B, and C’ then it may not make sense to construe that as ‘one or more widgets collectively having properties A, B, and C.’” *Id.* at 26. Patent Owner contends that a textual substitution of “one or more” for “a” is inappropriate here because “the claim language itself emphasizes the singular nature of ‘a ceiling tile’ by specifying a particular combination of a ceiling tile and the [beamforming microphone array (BMA)]: ‘a ceiling tile **combined with** the beamforming microphone array.’” *Id.* at 27.

Petitioner argues that nothing in claim 1 suggests that the beamforming microphone array must be physically installed in the ceiling tile to be considered “combined with” the ceiling tile. Reply 5. In one example (Fig. 2D), a panel containing a beamforming microphone array is suspended from a drop ceiling using hanger wires or cables. *Id.* (citing Ex. 1001, 8:9–18, Figs. 2B–2E). In another example, Petitioner argues, Figure 2H shows a ceiling tile embodiment in which a microphone array is installed in a different structure which, in turn, is attached to the ceiling tile using hooks. *Id.* at 5–6 (citing Ex. 1001, 10:20–23, Fig. 2H). According to Petitioner, “[t]here is no reason to differentiate between the hooks that attach the structure containing the microphones to the ceiling tile in Figure 2H and the cables that do the same for multiple ceiling tiles in Figures 2B–2E.” *Id.* at 6.

We disagree with Patent Owner that the claim limitation at issue here specifies a single device that has multiple properties. Rather, claim 1 broadly recites “a ceiling tile combined with the beamforming microphone

array.” We agree with Petitioner that the plain language of claim 1 does not require that the entire beamforming microphone array is physically integrated into a single ceiling tile, as combining a ceiling tile and a microphone array is broader than physically installing the microphone array in the ceiling tile. Nor can the language of claim 1 reasonably be read to exclude combining more than one ceiling tile with the microphone array. Where claim 1 assigns specific properties to a ceiling tile, it does so expressly, reciting “the ceiling tile being sized and shaped to be mountable in a drop ceiling in place of at least one of a plurality of ceiling tiles included in the drop ceiling.” Thus, the plain language of claim 1 requires at least one ceiling tile combined in some way with a beamforming microphone array, and each ceiling tile (if there is more than one) is a particular size and shape.

Both Petitioner and Patent Owner argue that the Specification supports their respective constructions. The Specification describes several “exemplary embodiments,” or “usage configurations of the beamforming microphone array,” corresponding to Figures 2A–2J. Ex. 1001, 3:14–16.

Patent Owner points to the embodiments of Figures 2F–2I as supporting its construction. PO Resp. 28–29 (citing Ex. 1001, 9:38–11:18). Patent Owner (*id.* at 29) focuses specifically on the Specification’s statement that “[i]n a third example (FIGS. 2F to 2I), the Array 116 with BFMs 212 and the NBFMs may be combined to a ceiling tile for a drop ceiling mounting configuration 260.” Ex. 1001, 9:38–40. According to Patent Owner, pointing to other instances where the Specification uses the term “combined,” “[w]hen the array 116 is ‘combined’ with other entities, that entity is a singular entity, such as a single wall tile or a single lighting fixture.” PO Resp. 29 (citing Ex. 1001, 9:38–11:18).

Petitioner contends that the Specification describes several embodiments showing a beamforming microphone array combined with multiple ceiling tiles, referring to the examples in Figures 2B–2E specifically. Reply 4–5 (citing Ex. 1001, 8:9–18, Figs. 2B–2E). Petitioner (*id.* at 5) focuses on Figure 2D, reproduced below (with Petitioner’s annotations):

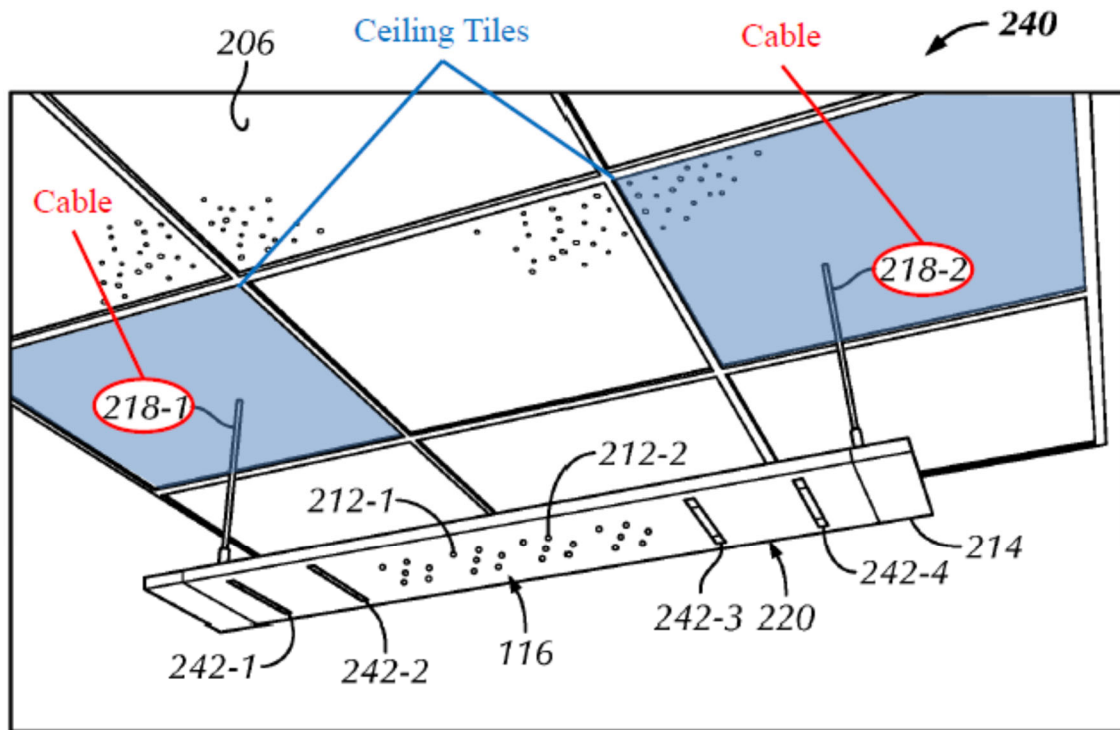


FIG. 2D

Annotated Figure 2D illustrates a usage configuration of a beamforming microphone array, with blue color and a label added to two ceiling tiles and labels added to two cables. Reply 5. In Figure 2D, beamforming microphone array 116 is “combined with one or more utility devices such as lighting fixtures 210, 230, 240, 250,” and “[a]ny of the lighting fixtures 210, 230, 240, 250 may include a panel 214 being appropriately suspended from the ceiling 206 (or a drop ceiling) using hanger wires or cables such as 218-1

and 218-2 over the first set of users 104 at an appropriate height from the ground.” Ex. 1001, 8:9–18.

Patent Owner argues that these embodiments “are not ceiling-tile-[beamforming microphone array] combinations. Those are inapposite suspended ‘chandelier’ embodiments.” PO Resp. 29. Dr. Begault repeats this argument in his testimony without adding to it materially. Ex. 2013 ¶ 24. We disagree. Figure 2D clearly depicts a combination of a beamforming microphone array (116), a lighting fixture (220), and two ceiling tiles, attached together with cables. Ex. 1001, 8:9–18.

Patent Owner argues

When referring to Figures 2B–2E, the array 116 is combined with a lighting fixture, not ceiling tiles. The specification does not use the term “combined” when referring to the *ceiling tiles* in Figures 2B–2E. In contrast, when referring to Figures 2F–2I, the array 116 is combined with ceiling tiles. The term “combined” is explicitly used to refer to the lighting fixtures of Figures 2B–2E and the ceiling tiles of Figures 2F–2I.

Sur-reply 4 (internal citations omitted). We are not persuaded. We do not read the Specification’s examples to define or limit “combined” to a physical integration of microphones into a single other entity.

Moreover, as we observed in the Institution Decision (at 33–34), the Specification also states that “the Array 116 may be configured for being combined with various room elements such as lighting fixtures 210, 230, 240, 250, ceiling tiles 264, and wall panels 294, a separate cost of installing the Array 116 in addition to the room elements may be significantly reduced, or completely eliminated.” Ex. 1001, 12:17–22. We determined that this passage expressly states that a beamforming microphone array can be combined with “ceiling tiles,” plural, which supports Petitioner’s construction. Dec. 34. Patent Owner attempts to distinguish this passage by

arguing that “the cited passage merely uses the plural form of ceiling tiles 264 to match the plural form of ‘various room elements,’” and that the description “a separate cost of installing the Array 116 in addition to the room elements may be significantly reduced, or completely eliminated” makes clear that the array is installed in a single room element, such as a single ceiling tile. PO Resp. 31–32 (citing Ex. 1001, 12:20–22). We do not read this passage as limiting the disclosure to installing a beamforming microphone array in a single ceiling tile. Rather, this passage expressly states that the array may be combined with more than one ceiling tile, supporting Petitioner’s proposed construction.

In sum, the Specification supports Petitioner’s proposed construction.

Patent Owner further argues that the prosecution history supports its proposed construction. Specifically, Patent Owner argues that, during prosecution of the ’297 application, Patent Owner described its invention to the Examiners as “a ceiling tile microphone that can replace a typical ceiling tile in a drop ceiling and provide the room with a beamforming microphone array that includes acoustic echo cancellation.” PO Resp. 32 (quoting Ex. 1003, 930 (emphasis Patent Owner’s)). We do not see this statement as a clear disavowal, disclaimer, or definition, such that we should depart from the plain language of the claims and the examples in the Specification.

We also do not find persuasive Dr. Begualt’s testimony on combining beamforming arrays with ceiling tiles, or the District Court’s findings regarding a different patent, when considered in the context of the intrinsic evidence. PO Resp. 32–33; *Phillips*, 415 F.3d at 1317–19.

Patent Owner argues that we should follow the nonprecedential decision in *Wonderland NurseryGoods Co. v. Baby Trend, Inc.*, 727 Fed. App’x 1017 (Fed. Cir. 2018). PO Resp. 34–36. In *Wonderland*

NurseryGoods, the ordinary language of the claims indicated that “a fabric member” was “a single fabric member” and the specification supported that construction. 727 Fed. App’x at 1019. As explained above, however, the ordinary meaning of “a ceiling tile combined with the beamforming microphone array” is consistent with “one or more ceiling tiles” and the Specification supports that meaning. Thus, as we noted in the Institution Decision, *01 Communique Laboratory* is applicable here and we follow it. Dec. 34–35. On the complete record, we maintain our construction that “a ceiling tile” means “one or more ceiling tiles.”

2. “*beamforming microphone array*”

Petitioner contends that “beamforming microphone array” means “a plurality of microphones and hardware or a combination of hardware and software in communication with the plurality of microphones.” Pet. 22. Petitioner argues that “the claimed ‘beamforming microphone array’ encompasses more than just the ‘plurality of microphones of the beamforming microphone array.’ It also must include hardware or a combination of hardware and software in communication with the microphones to perform these functions.” *Id.* at 23 (citing Ex. 1001, 7:10–29).

Patent Owner argues that Petitioner’s proposal is incorrect in two respects. First, Patent Owner argues that a beamforming microphone array need not include a separate digital signal processor (DSP), in light of arguments that Petitioner made in the Illinois case involving the related, but different ’806 patent. PO Resp. 16–18. Petitioner argues that Patent Owner has mischaracterized its proposed construction. Reply 2–3. This appears to

be a dispute relevant to the Illinois case, rather than this proceeding. Accordingly, we need not address it here.

Second, Patent Owner argues that our construction “should reflect the fact the microphones of a [beamforming microphone array] are located in positions relative to each other, by design, to establish constructive interference in one or more preferred beam directions.” PO Resp. 18–19 (citing Ex. 2013 ¶¶ 31–37, 48). Petitioner responds that claim 1 recites “beamforming” broadly and that Patent Owner attempts to limit “beamforming” to one technique out of several, including techniques that determine time delay between microphones rather than knowing the distances between the microphones. Reply 3 (citing Ex. 1029 ¶¶ 11–21). The parties’ competing proposals here are directed to Petitioner’s allegations that CTG System and Levit render the challenged claims obvious. However, as explained below, Petitioner has not established whether CTG System performs beamforming under either proposed construction. Thus, we need not resolve the parties’ claim construction dispute. *See Nidec*, 868 F.3d at 1017; *Vivid Techs.*, 200 F.3d at 803.

C. Petitioner’s Asserted Grounds

Petitioner contends that claims 1–24 are unpatentable based on (1) indefiniteness (as to the term “adaptive acoustic processing” in claims 1, 9 and 17); (2) lack of enablement (as to the term “adaptive acoustic processing”); (3) lack of written description (as to the term “adaptive acoustic processing”); (4) new matter and lack of written description (as to the term “an outer surface of the ceiling tile is acoustically transparent” in claims 1, 9 and 17); (5) obviousness over Graham and Levit; (6) obviousness

over CTG System and Levit; and (7) obviousness over CTG System, Beaucoup, and Levit. Pet. 18.

1. Ground 1: Indefiniteness of “adaptive acoustic processing that automatically adjusts to a room configuration”

Petitioner contends that the claim language “the beamforming microphone array includes adaptive acoustic processing that automatically adjusts to a room configuration,” recited in claim 1 (and similarly recited in claims 9 and 17), is indefinite. Pet. 29–30. As explained below, Petitioner has not made a sufficient showing.

35 U.S.C. § 112(b) requires that “[t]he specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.” When evaluating the “definiteness” requirement of § 112(b), “the Board shall follow *Nautilus [Inc. v. Biosig Instruments, Inc., 572 U.S. 898 (2014)]* in AIA post-grant proceedings.” USPTO Memorandum on the Approach to Indefiniteness Under 35 U.S.C. § 112 in AIA Post-Grant Proceedings (Jan. 6, 2021),³ 5 (“Because the office’s claim construction standard in AIA post-grant proceedings now aligns with that used by courts in a civil action, and because indefiniteness questions are generally considered as part of the claim construction process, the office’s approach to indefiniteness in AIA post-grant proceedings should likewise align with that used by the courts following the Supreme Court’s decision in *Nautilus*. As with the claim construction standard, aligning the indefiniteness approach in AIA post-grant proceedings will promote consistency and efficient decision

³ Available at <https://go.usa.gov/xAzHB>.

making among coordinate branches of government that decide similar issues in co-pending proceedings.”). Section 112(b) “require[s] that a patent’s claims, viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty.” *Nautilus*, 572 U.S. at 910. According to the Supreme Court, “[t]he definiteness requirement, so understood, mandates clarity, while recognizing that absolute precision is unattainable.” *Id.* Under *Nautilus*, “a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” *Id.* at 901.

Petitioner argues that

the ’653 Patent does not explain what this “adaptive” processing entails, how to achieve any form of adaptive acoustic processing in the disclosed beamforming microphone array, what qualifies as adaptive acoustic processing such that a [person of ordinary skill in the art] could ascertain the limits of the claim, or even what a “room configuration” means.

Pet. 30. Petitioner’s argument is based primarily on the testimony of Dr. Vipperman. Pet. 32–36 (citing Ex. 1002 ¶¶ 81–101). Relying on this testimony, Petitioner argues that a skilled artisan “would have recognized that adaptive acoustic processing could mean at least processing relating to (1) noise reduction; (2) signal amplitude control and mixing; (3) echo cancellation; (4) de-reverberation; or (5) frequency modification and shaping.” *Id.* at 32. Dr. Vipperman testifies that a skilled artisan “would appreciate that ‘adaptive acoustic processing’ does not only potentially cover many different techniques, but that it may mean many different things.” Ex. 1002 ¶ 81. Contrary to his conclusion that this term is indefinite,

Dr. Vipperman’s testimony suggests that he knows what the term means and, indeed, he provides a detailed explanation of that meaning (albeit without citing to any evidentiary support).⁴ *Id.* ¶¶ 82, 85–102.

Notably, Petitioner’s position in the Petition was not that “adaptive acoustic processing” was unclear, but that it was broad, it could have several meanings, and the Specification does not identify which of the meanings might apply. Pet. 32–36; Ex. 1002 ¶¶ 93 (“In my opinion, the claimed ‘adaptive acoustic processing’ may be understood to mean each of these options but does not distinguish between them.”), 95 (same), 97 (same), 100 (same), 102 (same). Petitioner’s primary complaint in the Petition was that “[n]one of these techniques are described in the specification.” Pet. 32. Petitioner’s argument, then, was that, because “adaptive acoustic processing” could mean one or more of five processing techniques, and none of those techniques are described in the ’653 patent, the term is indefinite because “[n]either the specification nor the prosecution history provides any distinction between these possible interpretations.” *Id.* at 33; *accord id.* (“The claims are also indefinite because a [person of ordinary skill in the art] cannot reasonably evaluate, in view of the several types of adaptive acoustic processing, whether a particular method of such processing infringes the claims.”).

As explained in the Institution Decision, Patent Owner identified where each of Petitioner’s five enumerated possibilities for “adaptive

⁴ We noted in the Institution Decision that much of Dr. Vipperman’s testimony merely repeats Petitioner’s arguments, and Dr. Vipperman does not state the bases for his opinions; thus his opinions were not particularly helpful. Dec. 41; 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”).

acoustic processing” are described in the Specification. Dec. 41–43; Prelim. Resp. 56–60; Ex. 1001, 2:54–56, 6:18–20, 6:22–24 (noise reduction), 6:27–36 (signal amplitude control and mixing), 6:5–6, 11:48–55 (echo cancellation and de-reverberation), 5:67–6:4, 6:40–53, 6:57–59 (frequency modification and shaping). We concluded, based on the preliminary record, that the Specification adequately describes each of these techniques.

Dec. 41. Patent Owner again identifies the Specification’s description of Petitioner’s five enumerated examples of “adaptive acoustic processing.” PO Resp. 64–65. We explained in the Institution Decision that a term is not indefinite merely because it is broad. Dec. 42–43 (citing *BASF Corp. v. Johnson Matthey Inc.*, 875 F.3d 1360, 1367 (Fed. Cir. 2017) (“[T]he inference of indefiniteness simply from the scope finding is legally incorrect: ‘breadth is not indefiniteness.’” (quoting *SmithKline Beecham Corp. v. Apotex Corp.*, 403 F.3d 1331, 1341 (Fed. Cir. 2005)))).

We found that, on the evidence presented by Patent Owner (and absence of evidence in the Petition), the Specification appears to provide reasonable certainty as to the scope of “adaptive acoustic processing.” *Id.* at 43. Specifically, we found that the Specification describes each of Petitioner’s five enumerated techniques as a form of processing performed in preferred embodiments of the invention, albeit those techniques are not expressly labeled “adaptive acoustic processing.” *Id.* at 42 (citing Ex. 1001, 5:67–6:65). On the preliminary record, reading the term in light of the Specification, we found that a skilled artisan would have understood “adaptive acoustic processing” to mean any of the five techniques Petitioner identifies and, while broad, the term is not indefinite. *Id.* at 42–43.

Despite an obligation to identify in the Petition the evidence that supports its indefiniteness allegations,⁵ Petitioner largely failed to discuss the Specification. Pet. 30; *see also* Dec. 41 (“Despite enumerating five techniques that it contends exemplify ‘adaptive acoustic processing,’ Petitioner does little to address the description of those techniques in the Specification.”). In one passage cited by Petitioner, the Specification states that an “embodiment of Array 116 may include adaptive acoustic processing that automatically adjusts to the room configuration for the best possible audio pickup.” Ex. 1001, 6:13–16. Petitioner argues that this description “lacks any disclosure providing objective boundaries of the claim’s scope, either through definitions or working examples.” Pet. 30. Petitioner also acknowledges that the Specification “discusses acoustic echo cancellation (in general) as an additional feature from adaptive acoustic processing,” and admits that a skilled artisan “would have recognized that echo cancellation processing occurring automatically in response to a room configuration would be a meaning of adaptive acoustic processing.” *Id.* at 35 (citing Ex. 1001, 6:5–22). However, Petitioner does not discuss the rest of the Specification in the Petition. Petitioner should have addressed in the Petition the express descriptions of Dr. Vipperman’s enumerated examples of adaptive acoustic processing in the Specification in order to support its

⁵ Our rules require Petitioner to make its case in the Petition, including identifying “[h]ow the challenged claim is to be construed,” “the specific part of the claim that fails to comply with the statutory grounds raised and . . . how the identified subject matter fails to comply with the statute,” and “specific portions of the evidence that support the challenge.” 37 C.F.R. § 42.204(b). Indeed, “[t]he Board may exclude or give no weight to the evidence where a party has failed to state its relevance or to identify specific portions of the evidence that support the challenge.” *Id.* at § 42.204(b)(5).

otherwise conclusory statement that “[n]one of these techniques are described in the specification,” Pet. 32. If it was Petitioner’s position that these express descriptions were nevertheless not examples of adaptive acoustic processing, Petitioner should have made those arguments in the Petition.

In the Reply, Petitioner argues that claim 1 already recites “beamforming” and “acoustic echo cancellation,” claim 6 recites “a configurable pickup pattern for the beamforming,” claim 7 recites “adaptive steering technology,” and claim 8 recites “adjustable noise cancellation.” Reply 17. Thus, Petitioner argues, “adaptive acoustic processing” “must refer to a feature of the beamforming microphone array separate from” these features. *Id.* (citing *CAE Screenplates Inc. v. Heinrich Fiedler GmbH & Co.*, 224 F.3d 1308, 1317 (Fed. Cir. 2000)). Petitioner further argues that the Specification “identifies ‘adaptive acoustic processing that automatically adjusts to the room configuration for the best possible audio pickup’ as a *separate feature* of the beamforming microphone array from acoustic echo cancellation, beamforming, adaptive steering technology, a configurable pickup pattern for the beamforming and adjustable noise cancellation.” *Id.* at 17–18 (citing Ex. 1001, 6:5–20). From this, Petitioner concludes that “the intrinsic evidence shows acoustic echo cancellation is definitively *not* within the breadth of the adaptive acoustic processing claim term because it is a separately claimed feature of the beamforming microphone array,” and that “[t]he claims and specification show that adjustable noise cancellation (*see* Petition, 34) is *not* within the breadth of ‘adaptive acoustic processing’ for the same reason.” *Id.* at 18. Patent Owner responds that acoustic echo cancellation may or may not be performed automatically; thus, its separate recitation would not, as a matter of claim construction, exclude acoustic

echo cancellation from “adaptive acoustic processing that automatically adjusts to a room configuration.” Sur-reply 23–24.

Petitioner further argues that a skilled artisan would have no way of knowing whether “three other possible interpretations of adaptive acoustic processing—signal amplitude control/mixing, de-reverberation, and frequency modification/shaping” are included within the scope of the term. Reply 18–19. Petitioner, however, offers no persuasive evidence that they are not included within the scope of the term or that it would have been unclear to a person of ordinary skill in the art whether these techniques are included within the scope of “adaptive acoustic processing.” Indeed, Dr. Vipperman admits that “adaptive acoustic processing” could mean one of five enumerated techniques; Patent Owner has shown where each of those techniques is described in the Specification; and Petitioner does not introduce persuasive evidence that anything in the Specification indicates to a person of ordinary skill in the art that any of those techniques nevertheless would have been excluded from adaptive acoustic processing. Moreover, even if Petitioner had shown that the Specification excludes these “three other possible interpretations of adaptive acoustic processing,” Reply 18–19, it would be evidence that the term as used in the Specification is narrower than Dr. Vipperman’s broad understanding, not that it is indefinite.

In the Petition, Petitioner also argues that the prosecution history “fails to explain the meaning of ‘adaptive acoustic processing,’” and that “the Examiner did not address the meaning or scope of this claim term.” Pet. 31 (citing Ex. 1002 ¶ 78). As Patent Owner points out (PO Resp. 65–67), this is not accurate. During prosecution, although neither the Examiner nor the applicant stated an express definition for the term, the Examiner considered the term “adaptive acoustic processing” at length, including in

the context of indefiniteness, and found it to be clear. We discussed this in detail in the Institution Decision. Dec. 23–25, 43–44; *see also Nature Simulation Sys. Inc. v. Auotdesk, Inc.*, 2020-2257, slip op. at 16 (Fed. Cir. Jan. 27, 2022):

Actions by PTO examiners are entitled to appropriate deference as official agency actions, for the examiners are deemed to be experienced in the relevant technology as well as the statutory requirements for patentability:

We presume that an examiner would not introduce an indefinite term into a claim when he/she chooses to amend the claim for the very purpose of putting the application in a condition for allowance.

(quoting *Tinnus Enters., LLC v. Telebrands Corp.*, 733 F. App’x 1011, 1020 (Fed. Cir. 2018)).

Specifically, the original claims of the application for the ’653 patent did not include “adaptive acoustic processing.” Ex. 1003, 82–84. Patent Owner added that language through an amendment to then-pending claim 25, which depended from then-pending claim 16, and to other pending claims 35 and 44. *Id.* at 939 (July 18, 2019, Response to Office Action). The Examiner rejected claims 25, 35, and 44 as lacking written description and as indefinite for their recitation “where the beamforming microphone array includes adaptive acoustic processing that automatically adjusts to the room configuration for the best possible audio pickup.” *Id.* at 1133–35 (Aug. 21, 2019, Office Action, at 5–7). Patent Owner responded with arguments and a declaration from named inventor Graham and participated in an interview with the Examiner. *Id.* at 1175–81 (Graham Decl.), 1188–90 (Nov. 20, 2019, Response, at 12–14), 1233–34 (Examiner-Initiated Interview Summary) (“The Examiner initially conveyed to the Applicant that claims 16, 26, and 36 would be allowed (after overcoming a few 112

defects) if the claims included the subject matter of claims 19 or 25. An agreement was reached in which the Applicant authorized an Examiner's amendment to include the substance of claim 25 [which included the term 'adaptive acoustic processing that automatically adjusts to a room configuration'] into claims 16, 26, and 36 with a minor omission of the language that reads 'for the best possible audio pickup.'"). The Examiner subsequently removed the language "for the best possible audio pickup," moved the rest of this limitation into the pending independent claims via an Examiner's amendment, and allowed the amended independent claims, specifically noting that this language distinguished the claims over prior art. *Id.* at 1226–31 (Feb. 4, 2020, Notice of Allowance). Thus, the Examiner brought his expertise to bear on the same claim language at issue here, in the context of indefiniteness, and found the language to be clear. In the Institution Decision, we found this evidence persuasive. Dec. 43–44. We still find that this is strong evidence that the '653 patent's claims, viewed in light of the Specification and prosecution history, inform those skilled in the art about the scope of "adaptive acoustic processing" with reasonable certainty.

We are also not persuaded by Petitioner's argument that a person of ordinary skill in the art could not ascertain what "room configuration" means. Although Petitioner argues that a skilled artisan would not have understood what "room configuration" means or how to determine a room configuration, Petitioner's only evidence to support this argument is the conclusory testimony of Dr. Vipperman, who merely repeats Petitioner's argument without identifying the basis for his testimony. Pet. 29–30; Reply 19 (citing Ex. 1002 ¶¶ 76, 82, 86, 99). Such testimony is of limited value. *See* 37 C.F.R. § 42.65(a).

Patent Owner argues that “[a] patent specification need not provide guidance as to the meaning of facially clear language such as ‘room configuration.’” Sur-reply 23 (citing *Interactive Gift Express, Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1331 (Fed. Cir. 2001)). Patent Owner also points out in the Sur-reply (at 24–25) that Dr. Vipperman testifies that signal control/mixing could “include automatic gain control, which adaptively normalizes and maintains a desired output volume when receiving a signal with varying input level (e.g., normalizing the output volume of a speaker that is walking around a room and changing position with respect to a stationary microphone),” and that de-reverberation “schemes rely on full or partial models of the room, which can be represented by the room impulse response,” and that “[w]hen the room configuration changes, the room impulse changes, and the de-reverberation scheme would need to be updated to adapt to the changing room configuration.” Ex. 1002 ¶¶ 94, 99. Patent Owner argues that these are admissions that a skilled artisan would have understood the meaning of “room configuration,” at least in the context of signal amplitude control/mixing and de-reverberation. Sur-reply 24. We agree that Dr. Vipperman’s admissions further undermine Petitioner’s already deficient showing.

On the complete record, including the description in the Specification, the prosecution history, and Dr. Vipperman’s admissions, we conclude that Petitioner has not shown, by a preponderance of the evidence, that “adaptive acoustic processing that automatically adjusts to a room configuration” renders claims 1–24 indefinite.

2. *Ground 2: Enablement of “adaptive acoustic processing that automatically adjusts to a room configuration”*

Petitioner contends that claims 1–24 are not enabled because the claim term “adaptive acoustic processing that automatically adjusts to a room configuration,” as recited in claims 1, 9 and 17, lacks enablement under 35 U.S.C. § 112(a). Pet. 37–44. As explained below, Petitioner has not made a sufficient showing.

“To prove that a claim is invalid for lack of enablement, a challenger must show . . . that a person of ordinary skill in the art would not be able to practice the claimed invention without undue experimentation.” *Enzo Life Sciences, Inc. v. Roche Molecular Sys., Inc.*, 928 F.3d 1340, 1345 (Fed. Cir. 2019) (citations and quotation marks omitted). Factors to be considered in determining whether a disclosure would require undue experimentation include:

(1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims.

In re Wands, 858 F.2d 731, 737 (Fed. Cir. 1988).

As to “the breadth of the claims,” referring to its indefiniteness allegations, Petitioner argues that a skilled artisan “would have known there were many different types of adaptive acoustic processing that one could attempt to implement in a microphone array system.” Pet. 38 (citing Ex. 1002 ¶ 105). Petitioner argues that the Specification must “enable the *full scope*” of “adaptive acoustic processing,” including these different types. *Id.* As noted above, Petitioner alleges that “adaptive acoustic processing” might include “(1) noise reduction; (2) signal amplitude control

and mixing; (3) echo cancellation; (4) de-reverberation; or (5) frequency modification and shaping.” *Id.* at 32 (citing Ex. 1002 ¶ 81).

As to the “amount of direction or guidance” the Specification provides, Petitioner argues that column 6, lines 13–16, “merely repeats the claim language, with the addition of ‘for the best possible audio pickup.’” *Id.* at 39. Petitioner’s allegations assume that the Specification’s only description of this term is its literal use of the term “adaptive acoustic processing.” *Id.* Petitioner does not address other disclosures in the Specification relevant to the term “adaptive acoustic processing.” *Id.* As we noted in the Institution Decision, Patent Owner pointed out where the Specification describes each of the techniques Dr. Vipperman admits could be adaptive acoustic processing. Dec. 45 (citing Prelim. Resp. 61; Ex. 1001, 6:5–65). *See also* PO Resp. 69–70 (citing Ex. 1001, 2:54–56, 5:67–6:4, 6:5–6, 6:18–20, 6:22–24, 6:40–44 6:60–65, 11:48–55; Ex. 1004 (file history for U.S. App. No. 14/475,849 (“the ’849 application”)), 40–61 (’849 application ¶¶ 41, 42, 62, 76–84); and Ex. 1008 (file history for U.S. Prov. App. 61/771,751 (“the ’751 application”)), 8, 9, 47, 48 as providing “direction and guidance that the petition simply fails to address.”).

As to the “presence or absence of working examples,” Petitioner argues that the Specification, at column 6, lines 13–16, provides no working examples and “merely states the claimed beamforming microphone array performs such adaptive acoustic processing, without explaining what it is or how it is achieved.” Pet. 39–40. Petitioner also argues that two provisional applications, specifically an appendix filed with those applications including a marketing brochure, does not provide working examples of adaptive acoustic processing. *Id.* at 40 (citing Ex. 1003, 1179–80 (¶¶ 22–23); Ex. 1007, 19; Ex. 1008, 8; Ex. 1002 ¶ 110). According to Petitioner, “even

if the Beamforming Microphone Array [of the marketing brochure] is deemed a working example, the wholesale lack of disclosure would not have enabled a [person of ordinary skill in the art] to practice the claimed subject matter.” *Id.* Petitioner again does not address any of the other examples in the Specification.

As to the “relative skill of those in the art,” Petitioner argues that a skilled artisan “would have been aware of some options for adaptive acoustic processing,” but due to “the total lack of information in the ’653 patent,” the skilled artisan “would not have been able to implement each of the various options for adaptive acoustic processing, particularly in a manner that automatically adjusts to a room configuration.” *Id.* at 41. Petitioner again does not address any of the examples provided by the Specification.

Similarly, as to the “nature of the invention,” Petitioner argues a “wholesale lack of corresponding detail or explanation,” but does not address the portions of the Specification that describe at least some of this detail. *Id.* at 41–42.

As to the “state of the prior art,” Petitioner argues that while the prior art teaches certain types of adaptive acoustic processing (e.g., noise reduction and de-reverberation), the breadth of the claimed adaptive acoustic processing that automatically adjusts to a room configuration—spanning many forms of acoustic and spatial processing—would nevertheless require a [person of ordinary skill in the art] to conduct undue experimentation to practice the full scope of the claims. Pet. 42 (citing Ex. 1002 ¶ 116). Petitioner does not address the examples in the Specification.

As to the “predictability or unpredictability of the art,” Petitioner argues that “[t]he predictability of the field was not such that a [person of ordinary skill in the art] would have found the adaptive acoustic processing

claim feature enabled by the '653 Patent's disclosure." Pet. 43. Petitioner, however, does not address any of the Specification's disclosure. *Id.* at 42–43.

As to the “quantity of experimentation necessary,” Petitioner argues that “[a person of ordinary skill in the art] attempting to implement all of these various techniques would not have been able to do so through routine experimentation, and would have needed to devote months or years of effort to implementing all of the different variations of adaptive acoustic processing into a beamforming microphone array.” Pet. 43–44 (citing Ex. 1002 ¶ 118). Petitioner again does not address any of the Specification's disclosure. *Id.*

As we observed in the Institution Decision (at 46), Dr. Vipperman's testimony largely repeats Petitioner's arguments and, in any case, does not address the description in the Specification that corresponds to the examples Petitioner contends would have been adaptive acoustic processing and, in most cases does not identify the bases for his testimony. Ex. 1002 ¶¶ 105–121. Thus, this testimony is entitled to little weight.⁶

As we observed in the Institution Decision, “the Specification provides several examples of the types of processing that Petitioner contends would be adaptive acoustic processing, albeit not labeling them ‘adaptive acoustic processing.’ The Petition does not address any of these examples.” Dec. 45 (citing Prelim. Resp. 61; Ex. 1001, 6:5–65). As a result of its choice

⁶ Petitioner argues that it is the Petition that actually copied Dr. Vipperman's testimony, rather than the other way around. Reply 24. Regardless, Dr. Vipperman did not address the disclosure in the Specification that corresponds to the techniques he admits are examples of adaptive acoustic processing and in large part did not identify the bases for his testimony, making it of little value.

to limit its argument and evidence to the Specification's description at column 6, lines 13–16, Petitioner provided no argument or evidence in the Petition directed to whether the Specification's description of the techniques Dr. Vipperman admits are adaptive acoustic processing are enabling descriptions of those techniques. As Patent Owner argues, “[t]he specification provides direction and guidance that the petition simply fails to address.” PO Resp. 69–70 (citing Ex. 1001, 2:54–56, 5:67–6:6, 6:18–20, 6:22–24, 6:40–44, 6:60–65, 11:48–55).

In reply, Petitioner argues that, “for [Patent Owner] to prevail on enablement, the ’653 patent must enable *every one* of those five examples—the *full scope* of the claims.” Reply 20 (citing *Trs. of Bos. Univ. v. Everlight Elecs. Co.*, 896 F.3d 1357, 1364 (Fed. Cir. 2018); *Nat’l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1195–96 (Fed. Cir. 1999)). Petitioner argues that “[n]one of these examples are in fact linked to the concept of ‘adaptive acoustic processing that automatically adjusts to a room configuration.’” *Id.* at 21. Then, for the first time addressing the disclosure in the Specification, Petitioner argues that the ’653 patent does not enable de-reverberation and that Patent Owner “presents no evidence (including expert testimony) to the contrary.” *Id.* at 21–22. As to Dr. Vipperman’s other examples of adaptive acoustic processing, Petitioner argues that “[Patent Owner] has at most pointed to passages of the specification that roughly correspond to the general concepts of the five interpretations for ‘adaptive acoustic processing,’ but even if each is a type of ‘adaptive acoustic processing’ generally, not a single one of the passages identified by [Patent Owner] describes performing such signal processing *automatically in response to a room configuration.*” *Id.* at 22–23.

Petitioner then argues that “[Patent Owner] has *no expert evidence* for any of the § 112 invalidity issues, as Dr. Begault did not offer any testimony on indefiniteness, written description, or enablement (including rebuttal testimony for *any* of the *Wands* factors).” *Id.* at 25. Patent Owner responds that it “is not required to present evidence to rebut conclusory deficient analysis,” and that “[i]t suffices for [Patent Owner] to point out the deficiencies in the petition’s case, as the petitioner bears the burden of proof.” Sur-reply 25 (citing 35 U.S.C. § 326).

Petitioner’s arguments in the Reply are belated and improper. According to our Trial Practice Guide,

Generally, a reply or sur-reply may only respond to arguments raised in the preceding brief. 37 C.F.R. § 42.23 “Respond,” in the context of 37 C.F.R. § 42.23(b), does not mean proceed in a new direction with a new approach as compared to the positions taken in a prior filing. While replies and sur-replies can help crystalize issues for decision, a reply or sur-reply that raises a new issue or belatedly presents evidence may not be considered. The Board is not required to attempt to sort proper from improper portions of the reply or sur-reply.

Examples of indications that a new issue has been raised in a reply include new evidence necessary to make out a prima facie case for the patentability or unpatentability of an original or proposed substitute claim, such as newly raised rationale to combine the prior art references that was not expressed in the petition. . . . It is also improper for a reply to present new evidence (including new expert testimony) that could have been presented in a prior filing, for example newly cited prior art references intended to “gap-fill” by teaching a claim element that was not present in the prior art presented with the petition.

Patent Trial and Appeal Board, Consolidated Trial Practice Guide, 74–75 (Nov. 2019) (“TPG”), available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

Dr. Vipperman (Ex. 1002 ¶ 81) identified five examples of adaptive acoustic processing, all five of which are described in the Specification, and all five of which should have been addressed in the Petition. *See* 37 C.F.R. § 42.204(b)(4), (5). As explained above, Petitioner chose not to address any of those examples in the Petition, instead opting to focus on a single sentence in the Specification (Ex. 1001, 6:13–16) that used the precise words “adaptive acoustic processing.” Patent Owner identifies where the Specification describes Dr. Vipperman’s examples of adaptive acoustic processing. PO Resp. 69–70. Petitioner now attempts to argue that each of these examples lacks enablement and faults Patent Owner for not offering expert testimony to the contrary. Reply 21–25. First, Petitioner’s analysis of the Specification to show enablement is part of its *prima facie* case; presenting that case in the Reply is late. Second, Patent Owner was not obligated to offer expert testimony to rebut arguments that Petitioner did not present in the Petition. Patent Owner also did not have an opportunity to present expert testimony on the new arguments Petitioner presented in the Reply. *See* TPG, 73 (“The sur-reply may not be accompanied by new evidence other than deposition transcripts of the cross-examination of any reply witness.”). Thus, we decline to consider Petitioner’s Reply arguments.

In any case, even if we did consider those arguments, they would not be persuasive. Petitioner’s arguments that Patent Owner’s Specification examples are not enabled are simply attorney argument not supported by evidence. Reply 21–23. Petitioner’s citations to Dr. Vipperman’s testimony do not support those arguments, because, as explained above, the testimony is not directed to any of the description in the Specification beyond the single sentence at column 6, lines 13–16.

On the complete record, we conclude that Petitioner has not shown, by a preponderance of the evidence, that claims 1–24 lack enablement based on the term “adaptive acoustic processing that automatically adjusts to a room configuration.”

3. *Ground 3: Written Description Support for “adaptive acoustic processing that automatically adjusts to a room configuration”*

Petitioner contends that the Specification does not provide written description support for “adaptive acoustic processing that automatically adjusts to a room configuration.” Pet. 45–47. As explained below, Petitioner has not made a sufficient showing.

“The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same.” 35 U.S.C. § 112(a). The Federal Circuit “has consistently held that § 112, first paragraph⁷, contains a written description requirement separate from enablement.” *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). “[T]he test for sufficiency [of the written description] is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Id.*

Petitioner (Pet. 46) contends that the only disclosure in the Specification of adaptive acoustic processing is the statement that “another embodiment of Array 116 may include adaptive acoustic processing that

⁷ The AIA recodified 35 U.S.C. § 112, first paragraph, as 35 U.S.C. § 112(a). Pub. L. No. 112-29, 125 Stat. at 296–97.

automatically adjusts to the room configuration for the best possible audio pickup.” Ex. 1001, 6:13–16. Petitioner argues that this “literal recitation” of adaptive acoustic processing is insufficient. Pet. 46. Petitioner argues that the further statement, “for the best possible audio pickup,” “does not add detail to, or further clarify, any manner of adaptive acoustic processing used by the claimed beamforming microphone array.” *Id.* Petitioner argues that “the specification states a vague result for the claimed beamforming microphone array to achieve (i.e., adaptive acoustic processing), but does not describe how to achieve that result (i.e., how any sort of adaptive acoustic processing is performed).” *Id.* at 46–47. Petitioner further argues that the Specification is “silent as to the meaning of ‘room configuration.’” *Id.* at 47.

As noted above, Petitioner and Dr. Vipperman argue that “adaptive acoustic processing could mean at least processing relating to (1) noise reduction; (2) signal amplitude control and mixing; (3) echo cancellation; (4) de-reverberation; or (5) frequency modification and shaping.” Ex. 1002 ¶ 81; *accord* Pet. 32. In the Institution Decision, we noted that the Preliminary Response identified where each of these techniques is described in the Specification. Dec. 48–49; Prelim. Resp. 56–59 (citing Ex. 1001, 2:54–56, 6:18–20, 6:22–24 (noise reduction), 6:27–36 (signal amplitude control and mixing), 6:5–6, 11:48–55 (echo cancellation and de-reverberation), 5:67–6:4, 6:40–53, 6:57–59 (frequency modification and shaping)). We noted that the Petition did not address any of this description. Dec. 49. Patent Owner again advances this description in the Response. PO Resp. 73.

In the Reply, Petitioner repeats its arguments (presented for its indefiniteness ground) that acoustic echo cancellation and adjustable noise

cancellation are distinctly claimed features and, thus, not within the scope of adaptive acoustic processing. Reply 25–26. As explained above, this argument is not persuasive. Petitioner also argues, as it did for its indefiniteness ground, that the documents attached to the earlier provisional applications included only vague marketing language and do not provide support for adaptive acoustic processing. *Id.* at 26 (citing Ex. 1007, 19; Ex. 2013 ¶¶ 62, 64). This argument also is unpersuasive, as noted above. In any case, Petitioner, who bears the burden on this ground, does not address the description in the Specification cited by Patent Owner, which appears to describe each of Dr. Vipperman’s examples of adaptive acoustic processing.

Moreover, in the Institution Decision, we noted that the Examiner expressly addressed the written description support for “adaptive acoustic processing” and found it sufficient. Dec. 49. Patent Owner argues this evidence in its Response. PO Resp. 73–74. Specifically, the Examiner rejected then-pending dependent claims 25, 35, and 44 as lacking written description support for “where the beamforming microphone array includes adaptive acoustic processing that automatically adjusts to the room configuration for the best possible audio pickup.” Ex. 1003, 1133–34. Patent Owner, through arguments, declaration evidence, and an examiner interview, persuasively overcame this rejection. *Id.* at 1175–81, 1188–89, 1233–34. The Examiner subsequently removed the language “for the best possible audio pickup,” moved “where the beamforming microphone array includes adaptive acoustic processing that automatically adjusts to the room configuration” into the pending independent claims via an Examiner’s amendment, and allowed the amended independent claims, specifically noting that this language distinguished the claims over prior art. *Id.* at 1226–

31. This is additional persuasive evidence that Petitioner has not shown that the Specification lacks written description of “adaptive acoustic processing.”

On the complete record, we conclude that Petitioner has not shown, by a preponderance of the evidence, that claims 1–24 lack written description based on “adaptive acoustic processing that automatically adjusts to a room configuration.”

4. *Ground 4: Written Description/New Matter for “an outer surface of the ceiling tile”*

Petitioner contends that the “Original Specification,”⁸ filed with the ’297 application (the application for the ’653 patent) did not contain written description support for “an outer surface of the ceiling tile is acoustically transparent,” as recited in claims 1, 9, and 17. Pet. 47. According to Petitioner, the specification “was amended post-filing” to add support for this limitation. *Id.* Petitioner argues that this has two consequences. First, Petitioner argues that written description support for a claim cannot come from new matter filed after the filing date of the application and, thus, the claims are unpatentable under §§ 112(a) and 132(a). *Id.* at 47–48. Second, Petitioner argues that the challenged claims have an effective filing date no earlier than July 25, 2016, the filing date of the ’297 application, which makes Graham (a published version of the parent ’849 application to which the ’653 patent claims priority) prior art to the challenged claims (an issue we address in more detail below, in the context of Petitioner’s obviousness ground based on Graham and Levit). *Id.* at 12–17.

⁸ Petitioner refers to a version of the specification of the ’849 application, the parent to the ’653 patent, amended on February 9, 2016, as the “Original Specification.” Pet. 12 (citing Ex. 1004, 174–212).

Petitioner admits that “the Original Specification states that the ceiling tile can be acoustically transparent,” but argues that “it never references a ceiling tile having an *outer surface* that is acoustically transparent.” Pet. 12. Petitioner argues that the Original Specification describes other properties of the surface of a ceiling tile, including colors, designs, and textures, but that “[t]he only mention in the Original Specification of an acoustically transparent surface is in the context of a *wall*-mounted array.” *Id.* at 13–15 (citing Ex. 1004, 166–68 (¶¶ 53, 55, 57–58 of the amended specification filed in the parent ’849 application)). Petitioner argues that “[n]owhere does the Original Specification disclose *ceiling tiles* having inner and outer surfaces, with the outer surface made of acoustically transparent material and the array being mounted between the inner and outer surfaces.” *Id.* at 15. Petitioner further argues that “[t]he first mention, in any of the priority specifications, of ceiling tiles having an acoustically transparent ‘outer surface’ did not occur until further amendments on July 18, 2019.” *Id.* at 13 (citing Ex. 1003, 976 (¶ 11 of an amended specification filed in the ’297 application)).

Petitioner’s written description/new matter argument is based on its proposed construction of “an outer surface of the ceiling tile,” discussed above, which would require the outer surface of a ceiling tile to be distinct from the core of the ceiling tile. As noted in Section II.B above, we do not adopt Petitioner’s proposed construction and, instead, we give “an outer surface of the ceiling tile is acoustically transparent” its ordinary meaning.

Under an ordinary meaning construction, which we adopt, Patent Owner points to description that “[t]he ceiling tiles such as the ceiling tile 264 may be made of a variety of materials or combinations of materials including, but not limited to, metals, alloys, ceramic, fiberboards, fiberglass,

plastics, polyurethane, vinyl, or any suitable acoustically neutral material known in the art, related art, or developed later.” PO Resp. 76–77 (quoting Ex. 1004, 47 (¶ 54 of the unamended parent ’849 application filed Sept. 3, 2014)). According to Patent Owner, “[a]n acoustically neutral ceiling tile would necessarily have an acoustically transparent outer surface. The surface must be acoustically transparent so that the ceiling tile as a whole is acoustically neutral.” *Id.* at 77.

We agree with Patent Owner. When given its ordinary meaning, “an outer surface of the ceiling tile is acoustically transparent” has no requirements for the internal structure of the ceiling tile, contrary to Petitioner’s arguments. As noted above, Petitioner concedes that the Original Specification states that the ceiling tile as a whole can be acoustically transparent. Pet. 12. Petitioner further admits that “ceiling tiles that are entirely acoustically transparent will allow sound to pass through.” *Id.* Patent Owner also points to disclosure in the parent ’849 application that the ceiling tile can be made of an acoustically neutral material. PO Resp. 76–77; Ex. 1004, 47 (¶ 54). On the complete record, a ceiling tile that is entirely acoustically neutral/transparent necessarily would have an acoustically transparent outer surface. PO Resp. 77. Thus, Petitioner has not shown, by a preponderance of the evidence, that the term “an outer surface of the ceiling tile is acoustically transparent,” as recited in claims 1, 9, and 17, lacks written description support or is new matter. Instead, this term was supported at least as early as September 3, 2014, via the

specification filed on that date in the parent '849 application. Ex. 1004, 47 (¶ 54).⁹

5. *Ground 5: Obviousness of Claims 1–24 over Graham and Levit*

Petitioner contends that claims 1–24 would have been obvious over Graham, which as noted above is the publication of the parent '849 application, and Levit. Pet. 49–64. As explained below, Petitioner has not made a sufficient showing.

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are “such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” We resolve the question of obviousness on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of obvious or nonobviousness, i.e., secondary considerations.¹⁰ *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

⁹ Paragraph 54 of the September 3, 2014, specification remains substantially the same in the amended specification Patent Owner refers to as the Original Specification (renumbered ¶ 48 and adding “or transparent”). Specifically, both include the description Patent Owner relies on in its Response that the ceiling tiles can be made of “any suitable acoustically neutral” material, which we find sufficient to describe “an outer surface of the ceiling tile is acoustically transparent,” as recited in claim 1. *Compare* Ex. 1004, 47 with *id.* at 195. Patent Owner does not rely on the addition of “or transparent” and we do not either.

¹⁰ The complete record does not include allegations or evidence of objective indicia of obviousness or nonobviousness.

a) Scope and Content of the Prior Art

(1) Overview of Graham

Graham is the publication of the parent '849 application, filed September 3, 2014, and published March 19, 2015. Ex. 1010, codes (21), (22), (43). Petitioner asserts that Graham's description is substantially similar to that of the '653 patent. Pet. 49.

(2) Overview of Levit

Levit relates to ceiling tiles for use in a building interior. Ex. 1016 ¶ 2. According to Levit, acoustically absorbent ceiling tiles, with cores of acoustically absorbing materials, were known in the art. *Id.* ¶ 4. Levit also states that “[i]t is desirable that facings for covering acoustically absorbent materials be materials that are either acoustically transparent or absorbent, but not acoustically reflective, in order to enhance the absorption of sound.” *Id.* ¶ 5. Levit states that acoustically transparent facings for use with acoustically absorbent ceiling tiles were known in the art. *Id.* ¶ 23.

In Levit's invention, an “acoustically absorbing ceiling tile . . . includes an acoustically absorbing core and a nonwoven facing covering at least one surface of the core,” where “[t]he facing is acoustically transparent, in that the facing does not detract from the acoustic absorption of the core, or the facing can enhance the acoustical absorption of the ceiling tile core.” *Id.* ¶ 21. “The acoustically absorbing core includes any known acoustically absorbing material and/or an air space.” *Id.* ¶ 22. As to the facings of the ceiling tiles, Levit describes “[e]xamples of known acoustically transparent facings” that “include woven meshes, fabrics with low density and non-woven scrims.” *Id.* ¶ 28.

b) Obviousness of Claims 1–24 over Graham and Levit

Petitioner contends that the '653 patent is only entitled to an effective filing date of July 25, 2016 (the filing date of the '297 application); Graham, which is the publication of the parent '849 application, published March 19, 2015; and, therefore, Graham is prior art under 35 U.S.C. § 102(a)(1).

Pet. 17. As noted above in Section II.C.4 above, Petitioner argues that because the priority applications (including the parent '849 application) do not provide written description support for “where an outer surface of the ceiling tile is acoustically transparent,” as recited in claims 1, 9, and 17, the effective filing date of the '653 patent is July 25, 2016, after Graham's publication date, which makes Graham prior art to the challenged claims.

Id. at 16. Petitioner contends that Graham describes each limitation of the challenged claims except for “where an outer surface of the ceiling tile is acoustically transparent,” as recited in claim 1 (and similarly recited in claims 9 and 17), and “where the ceiling tile comprises acoustic or vibration damping material,” as recited in claim 5 (and similarly recited in claims 13 and 21). *Id.* at 52–55, 57–64. Petitioner cites Levit for those aspects of claims 1, 5, 9, 13, 17, and 21 that it does not find in Graham. *Id.* at 55–56, 58, 62–63. Petitioner argues that a skilled artisan “would have been motivated to combine Graham and Levit to incorporate Levit's acoustically absorbent ceiling tile having an acoustically transparent facing into Graham's beamforming microphone array combined with a ceiling tile.” *Id.* at 49.

As noted above, Petitioner submits that Graham discloses most of the limitations of claims 1–24. Pet. 52–55, 57–64. For claim 1, for example, Petitioner submits that Graham discloses all limitations except for “where an outer surface of the ceiling tile is acoustically transparent.” *Id.* at 52–56.

Here, Petitioner appears to be relying on disclosure also present in the specification filed on September 3, 2014. *Compare id.* (citing Ex. 1010 ¶¶ 2, 17, 33, 38, 51, 55, 56, 64, 65, 71, Fig. 2F), *with* Ex. 1004, 8–64 (Sept. 3, 2014, specification at ¶¶ 2, 17, 34, 40, 54, 57, 58, 66, 67, 73, Fig. 2F). As to the only limitation of claim 1 that Petitioner alleges is not disclosed in Graham (and the only limitation of the challenged claims Petitioner argues is new matter), for the reasons given in Section II.C.4 above, the September 3, 2014, specification of the '849 application provides written description support for “where an outer surface of the ceiling tile is acoustically transparent,” as recited in claim 1. Thus, the challenged claims find written description support in the parent '849 application, filed September 3, 2014, and are entitled to claim September 3, 2014, as their effective filing date. Because the challenged claims have an effective filing date at least as early as September 3, 2014, which is prior to Graham’s publication date of March 19, 2015, Graham is not 102(a)(1) prior art to the challenge claims.

Thus, Petitioner has not shown, by a preponderance of the evidence, that the challenged claims would have been obvious over Graham and Levit.

6. Ground 6: Obviousness of Claims 1–24 over CTG System and Levit

Petitioner contends that claims 1–24 would have been obvious over CTG System and Levit. Pet. 65–86. As explained below, Petitioner has not made a sufficient showing.

a) Scope and Content of the Prior Art—Overview of CTG System

CTG System is an audio system including omni-directional microphones, mixers, and ceiling tiles described in a set of marketing, sales,

and installation documents (Exs. 1011–1015, 1025–1028) and supported by the testimony (Ex. 1009) of David Newman, the President and owner of Conference Technology Group, LLC, who claims to have knowledge of the sales and implementation of CTG System. Petitioner relies primarily on the CTG Manual (Ex. 1011), the CM-01 Sell Sheet (Ex. 1012), and the FS-400/800 Sell Sheet (Ex. 1013). Pet. 65–66, 68–81, 84–86. Petitioner further relies on the CTG White Paper (Ex. 1014) and CTG FAQ (Ex. 1015) for certain dependent claims. *Id.* at 82–83.

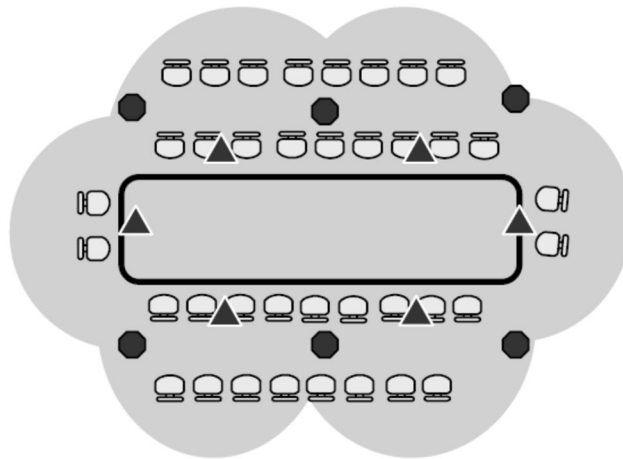
Petitioner argues that “[b]ecause the CTG System was described in a printed publication, in public use, on sale, and otherwise available to the public at least as early as 2009, it is prior art under 35 U.S.C. § 102(a)(1).” Pet. 66. However, Petitioner does not rely on a single reference to show all of the aspects of CTG System or present argument or evidence that a skilled artisan would have combined the teachings of the various exhibits it relies on. Therefore, Petitioner contends that CTG System is prior art by virtue of it being in public use or on sale. Reply 11–12.¹¹

CTG Manual provides instructions for the wiring and mounting of CTG microphones, speaker modules, and the connections to and operation of the FS-400/800 Beamforming Mixers. Ex. 1011, 3.¹² CTG Manual depicts how components such as ceiling microphones and ceiling speakers

¹¹ The parties dispute whether Petitioner has shown sufficiently that CTG System was on sale or in public use. Pet. 65–66 (citing Ex. 1009 ¶¶ 6, 8–11, 20); PO Resp. 44–45; Reply 11–12; Sur-reply 6–7. We need not resolve this dispute because Petitioner has not made its case even if CTG System was on sale or in public use, as explained below.

¹² We refer to the page numbers in the upper-left corners of the exhibit pages.

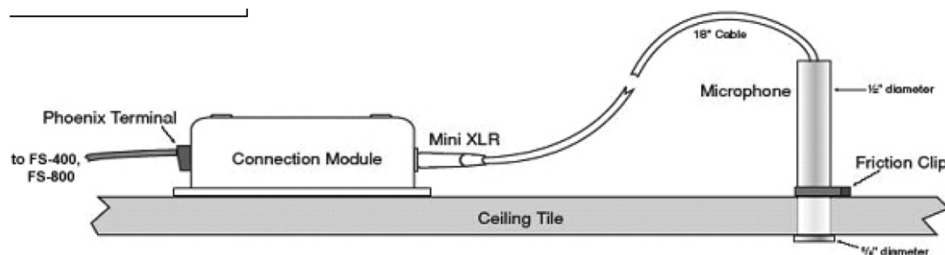
could be configured in relationship to a conference table, as shown in the figure reproduced below:



Centered conference table with perimeter seating
45'x30' coverage area

The figure above is a diagram of a conference room, showing the placement of ceiling microphones (triangles) and ceiling speakers (octagons) relative to a conference table and chairs and the coverage of the microphones (in gray). *Id.* at 4.

CTG Manual also describes how to install a CM-01 ceiling microphone in a ceiling tile. *Id.* at 5, 7. This is shown, for example, in the figure reproduced below:



The above figure is a diagram of a ceiling tile into which a microphone has been inserted and is held in place with a friction clip. *Id.* at 7. The microphone is connected to a connection module, which is mounted to the

top surface of the ceiling tile. *Id.* The connection module is further connected to an FS-400 or FS-800 Beamforming Mixer (not shown). *Id.*

CTG Manual further describes sound processing features of the CTG FS-400 and FS-800 Beamforming Mixers attached to the microphones, stating that “[t]he mixers provide advanced Echo Cancellation, Noise Reduction, and De-Reverberation to reduce the room reflections that can seriously degrade speech intelligibility.” *Id.* at 10; *see also id.* at 23 (component specification listing “Acoustic Echo Cancellation (AEC) tail length” of “150 ms”).

CM-01 Sell Sheet is a two page brochure listing the features of the CTG CM-01 ceiling microphone. Ex. 1012, 1–2. Among the listed “Applications/Benefits” are “[an] ultra smooth frequency response providing excellent feedback stability for voice reinforcement and teleconferencing applications,” “[a]llows furniture to be rearranged with no compromise to the audio system,” and “[p]rovides even pick up for the maximum number of participants with the minimum number of microphones.” *Id.* at 1.

FS-400/800 Sell Sheet is a two-page brochure listing the features of the FS-400 and FS-800 Beam Forming Mixers. Ex. 1013, 1–2. According to FS-400/800 Sell Sheet,

Using multiple microphones, this mixer calculates the direction and source of every sound in a room. It can determine if a sound is speech or noise. By measuring the difference in time and intensity of the speech in each microphone, the mixer effectively forms a beam aimed at the person speaking and adaptively follows that person as they move about the room.

Id. at 1. “Each Mixer can be daisy chained to additional mixers to support an unlimited number of microphones.” *Id.* FS-400/800 Sell Sheet also lists

“Independent Echo and Noise Cancellation on each microphone” and “De-Reverberation” as features the mixers provide. *Id.*

b) Differences, if any, between Claims 1–24 and the Combination of CTG System and Levit; Reasons to Modify or Combine

(1) Claim 1: Undisputed Limitations

The preamble of claim 1 recites “[a] ceiling tile microphone.” Petitioner contends that CTG Manual provides instructions for mounting a CM-01 microphone in a ceiling tile and, thus, teaches “[a] ceiling tile microphone.” Pet. 69 (citing Ex. 1011, 7). Petitioner also notes that CM-01 Sell Sheet describes its product as a “ceiling microphone.” *Id.* at 68–69 (citing Ex. 1012, 1).

As to “the beamforming microphone array picks up audio input signals,” as recited in claim 1, Petitioner cites to description in CM-01 Sell sheet that the CM-01 microphone “[p]rovide[s] even pick up for the maximum number of participants with the minimum number of microphones” and description in CTG Manual that microphones attached to the FS-400 and FS-800 mixers are “sampled 16,000 times per second and the audio picked up by each is analyzed and compared in arrival time.” *Id.* at 73–74 (citing Ex. 1012, 1; Ex. 1011, 10).

Petitioner further contends that descriptions of features such as algorithms for noise reduction/suppression and de-reverberation in CTG Manual and FS-400/800 Sell Sheet teach “the beamforming microphone array includes adaptive acoustic processing that automatically adjusts to a room configuration,” as recited in claim 1, should this claim term satisfy ¶ 112. *Id.* at 74–75 (citing Ex. 1011, 10; Ex. 1012, 1). As explained in

Sections II.C.1, II.C.2, and II.C.3 above, we are not persuaded that this claim term is indefinite or lacking in written description or enablement.

Petitioner does not contend that CTG System teaches “where an outer surface of the ceiling tile is acoustically transparent,” as recited in claim 1. Pet. 78. Petitioner cites Levit for this teaching. *Id.* at 66–68, 78. As noted above, Levit teaches that “[a]coustically absorbent ceiling tiles are known in the art for use reducing the amount of noise and/or reverberation within a given area, such as a building interior.” Ex. 1016 ¶ 4. As Petitioner argues, Levit describes a ceiling tile with an acoustically transparent outer surface covering an acoustically absorbing core. Pet. 67; Ex. 1016 ¶ 21.

Dr. Vipperman testifies that a skilled artisan “would have understood that the acoustically absorbing core of Levit’s ceiling tile would improve the acoustics of the room, thereby improving the quality of the audio picked up by the CM-01 microphones and processed by the FS-400/800 mixers.”

Ex. 1002 ¶ 172. Petitioner also argues that a skilled artisan would have been motivated by statements in Levit to make the proposed combination, including statements that “[f]acings for covering acoustic absorbent ceiling tiles serve as durable coverings that protect the core during handling, use and maintenance,” and that “[t]he facing of the ceiling tile has the desirable combination of barrier, i.e., resistance to penetration of water, dust and/or microorganisms, and porosity resulting in high air flow or permeability and good acoustical performance.” Ex. 1016 ¶¶ 5, 40; Pet. 67–68.

Dr. Vipperman testifies that a skilled artisan would have had a reasonable expectation of success making the combination. Ex. 1002 ¶ 174; Pet. 68.

(2) *Claim 1: “a beamforming microphone array that includes beamforming and acoustic echo cancellation, a plurality of microphones of the beamforming microphone array are positioned at predetermined locations”*

The parties dispute whether CTG System teaches “a beamforming microphone array that includes beamforming and acoustic echo cancellation, a plurality of microphones of the beamforming microphone array are positioned at predetermined locations,” as recited in claim 1.

As to “a beamforming microphone array that includes beamforming and acoustic echo cancellation,” as recited in claim 1, Petitioner argues that FS-400/800 Sell Sheet and CTG Manual describe beamforming and echo cancellation as features of the FS-400 and FS-800 Mixers. *Id.* at 69–70 (citing Ex. 1011, 10, 23; Ex. 1013, 1). Petitioner argues that these references describe the mixers as processing signals input from the CM-01 microphone mounted in the ceiling tile. *Id.* at 70–71 (citing Ex. 1011, 7, 12; Ex. 1013, 1). To show that CTG System performs beamforming, Petitioner relies, in particular, on FS-400/800 Sell Sheet, which states:

Using multiple microphones, this mixer calculates the direction and source of every sound in a room. It can determine if a sound is speech or noise. By measuring the difference in time and intensity of the speech in each microphone, the mixer effectively forms a beam aimed at the person speaking and adaptively follows that person as they move about the room. Constantly analyzing each microphone in real time, usable acoustic information is added from microphones that may not appear in nearby microphones.

Pet. 69–70 (quoting Ex. 1013, 1). As to this disclosure, Dr. Vipperman testifies: “Measuring the difference in time and intensity of the speech in each microphone is one technique for performing beamforming. And in my opinion, forming a beam aimed at a speaker and adaptively following that

speaker as they move describes a microphone array performing beamforming.” Ex. 1002 ¶ 176. Dr. Vipperman does not state the basis for this opinion.

Petitioner further contends that CTG Manual depicts an example conference table configuration in which the microphones are connected to the mixers and together are arranged as a beamforming array. Pet. 71 (citing Ex. 1011, 4; Ex. 1002 ¶ 179). Specifically, Petitioner points to the conference room example in the picture reproduced above. *Id.* Petitioner relies on CTG Manual to show that the CM-01 microphones are connected to the FS-400/800 mixers. *Id.* at 70–71 (citing Ex. 1011, 7, 12; Ex. 1002 ¶ 178).

As to “the plurality of microphones of the beamforming microphone array are positioned at predetermined locations,” Petitioner again points to the conference room example (picture reproduced above) in CTG Manual showing microphones positioned in locations above a conference table. *Id.* at 72–73 (citing Ex. 1011, 4; Ex. 1002 ¶ 180). Dr. Vipperman testifies that a skilled artisan “would understand, the claims and the specification [of the ’653 patent] are not specific about what it means for microphones to be ‘positioned at predetermined locations,’” that “the meaning of ‘predetermined locations’ collapses into the meaning of ‘beamforming,’ as discussed above, such that the spacing between microphones can be known and used in order to perform beamforming,” and that “[n]o other meaning of ‘predetermined locations’ for microphones is disclosed or suggested in the specification.” Ex. 1002 ¶ 180.

Petitioner further argues that FS-400/800 Sell Sheet describes beamforming functionality in its description of mixers “measuring the difference in time and intensity of the speech in each microphone [to]

effectively form[] a beam aimed at the person speaking and adaptively follow[] that person as they move about the room.” *Id.* at 73 (citing Ex. 1013, 1; Ex. 1002 ¶ 181). Dr. Vipperman testifies that a person of ordinary skill in the art

would have understood that the microphones in the microphone array are positioned at predetermined locations so that the FS-400/800 mixer can “effectively form[] a beam aimed at the person speaking and adaptively follow[] that person as they move about the room” based on the measured difference in time and intensity. The FS-400/800 would need to know the locations of each of the microphones so that it could calculate the difference in time and intensity of the speech at each microphone in the array and effectively form the beam.

Ex. 1002 ¶ 181 (quoting Ex. 1013, 1 (alterations by Dr. Vipperman)).

Patent Owner argues that Petitioner does not show sufficiently that CTG System performs beamforming and, rather, the evidence suggests otherwise. PO Resp. 39–50. Patent Owner first attacks the competence of Petitioner’s evidence (*id.* at 39–44) and then argues that the evidence suggests that CTG System performs something other than beamforming (e.g., gating) (*id.* at 45–50).

In addressing the competence of Petitioner’s evidence, Patent Owner first takes issue with Mr. Newman’s testimony. *Id.* at 40–44. Mr. Newman testifies:

The concept of beamforming has been around in our business for many years. Beamforming is a signal processing technique that focuses audio pickup in a certain direction. In 2008, CTG worked with Phoenix Technologies, Inc. (“Phoenix”) to offer a beamforming mixer for use with CTG’s microphones. The mixers were released as the FS-400 (designed to work with four CM-01 microphones) and the FS-800 (designed to work with eight CM-01 microphones). Multiple mixers could be connected to harness the range of even more ceiling-mounted

microphones. The FS-series mixers used voice activity detectors to isolate and combine signals from microphones picking up talkers in the room and accounted for time delays in signal arrival to these microphones.

Ex. 1009 ¶ 19. However, Mr. Newman admitted that the software in the CTG System mixers that performs the alleged beamforming was written by a supplier, Phoenix, and that his understanding that the mixers performed beamforming was based on his conversations with people at Phoenix, rather than his own review of the software. Ex. 2011, 45:3–13, 47:2–48:8.

Mr. Newman also admitted that he does not have a technical degree and has no engineering experience. *Id.* at 24:11–19. We agree with Patent Owner that Mr. Newman’s technical understanding of the CTG System appears very limited and, instead, his understanding of its features is purely from a marketing and sales perspective. We assign little weight to his testimony on the technical aspects of CTG system.

Patent Owner next takes issue with Petitioner’s reliance on FS-400/800 Sell Sheet (Ex. 1013), the document that Petitioner and Dr. Viperman primarily cite and quote when concluding that CTG System performs beamforming. PO Resp. 42–43. Patent Owner argues that this document is merely a short marketing document devoid of detail or precision. *Id.* at 42. Mr. Newman testified that he wrote that document, including the “Features/Benefits” section on which Petitioner relies, that he did not understand what several of the statements meant, did not know how the mixers performed the described features, and instead obtained much of the wording from Phoenix. Ex. 2011, 57:15–61:11. Petitioner argues that the language it cites was drafted by Phoenix, who wrote the software that implements the alleged beamforming. Reply 7. We note that Petitioner has not introduced any evidence obtained from Phoenix, the entity that appears

to be in possession of the technical details of the alleged beamforming performed by the CTG System. FS-400/800 Sell Sheet appears to be of limited value. The document itself, as Patent Owner notes (PO Resp. 43), provides only a vague and high-level description of functionality that might or might not constitute beamforming. Moreover, it was written in part by a witness who admits that his understanding of its technical details is limited and in part by unnamed people at Phoenix who have not participated in this trial.

As to Dr. Vipperman's testimony, Patent Owner argues that he "relies on exhibits that he does not understand, taking their recitation of 'beamforming' at face value without any independent knowledge of what those mixers do." PO Resp. 43 (citing Ex. 1002 ¶ 176). Petitioner admits that Dr. Vipperman did not analyze the CTG System product or perform any testing on it and, instead, simply relies on the statements in the marketing and sales literature (e.g., FS-400/800 Sell Sheet). Tr. 10:26–12:7, 21:10–12. Dr. Vipperman's testimony adds little to the statements in FS-400/800 Sell Sheet, which, as we note above, are of little value in understanding the technical features of CTG System. Dr. Vipperman also contradicts his own testimony, as we explain below.

Patent Owner also argues that, despite using the term "beamforming," the FS-400/800 mixers of CTG System do not in fact perform beamforming. PO Resp. 45–50. Patent Owner argues that the documents themselves put "beamforming" in quotes and qualify the identification of beamforming with "effectively," suggesting that the mixers perform something other than literal beamforming. *Id.* at 45–46 (citing Ex. 1013, 1; 1027, 1). Dr. Begault testifies that, if the microphones are spaced apart as depicted in CTG Manual (Ex. 1011) and CTG White Paper (Ex. 1014) (e.g., about six feet apart), the

microphones would be too far apart to focus or steer a beam. Ex. 2013 ¶¶ 65–66; PO Resp. 46–47 (citing Ex. 2013 ¶¶ 37–47, 50, 55, 65–66, 76). Petitioner responds that “[n]o evidence suggests that the quotes around ‘Beamforming’ in Ex. 1013 mean the CTG System did not performing beamforming.” Reply 8. However, Patent Owner need not prove that CTG System performs something other than beamforming; instead, it is Petitioner’s burden to show that CTG System performs beamforming.

Patent Owner also argues that the mixers of the CTG system are not capable of receiving the locations of the microphones and that the arrangement of the microphones is arbitrary. PO Resp. 47–48. Dr. Begault testifies that the mixers’ microphone inputs depicted in FS-400/800 Sell Sheet, along with a lack of specification of microphones to be used, suggest that no particular microphone arrangement is specified. Ex. 2013 ¶ 67 (citing Ex. 1013, 2). Dr. Begault further testifies that “these mixers are incapable of being programmed with information regarding the location of the microphones” because “[t]he exhibits clearly show that there is no software or hardware interface that would allow specification by a user as to microphone locations.” *Id.* ¶ 74. Patent Owner argues that CTG System instead performs source-tracking, which follows a sound source around a room by gating microphones on and off. PO Resp. 48–49 (citing Ex. 2013 ¶¶ 56–60, 70–73).

In response, Dr. Vipperman changes his testimony. According to Dr. Vipperman’s Reply testimony:

Beamforming does not require that the geometry of the array be known. Rather, beamforming can be “blind” or geometry-agnostic. While the manner of beamforming is not described in the available CTG literature, methods of “blind” or geometry-agnostic beamforming in the prior art involved maximizing the

signal to noise ratio or post-filtering. . . . Another method of blind beamforming is achieved by simply measuring the relative time delays between microphones and then delaying each microphone signal accordingly before summing them together to create a delay-and-sum beamformed output. These relative time delays could, for example, be measured using cross correlation functions in the time domain.

Ex. 1029 ¶ 11; *see also id.* ¶¶ 12–21 (elaborating on Dr. Vipperman’s new theory and introducing new evidence); Reply 8–9 (advancing Dr. Vipperman’s new testimony).

Dr. Vipperman’s new testimony is contradictory to the testimony he provided with the Petition. At the time of the Petition, Dr. Vipperman testified that “the meaning of ‘predetermined locations’ [of claim 1] collapses into the meaning of ‘beamforming,’ as discussed above, such that the spacing between microphones can be known and used in order to perform beamforming,” and that “a [person of ordinary skill in the art] would have understood that the microphones in the microphone array are positioned at predetermined locations so that the FS-400/800 mixer can ‘effectively form[] a beam aimed at the person speaking and adaptively follow[] that person as they move about the room’ based on the measured difference in time and intensity.” Ex. 1002 ¶¶ 180–181 (quoting Ex 1013, 1 (alterations by Dr. Vipperman)). He expressly testified that “[t]he FS-400/800 *would need to know the locations of each of the microphones* so that it could calculate the difference in time and intensity of the speech at each microphone in the array and effectively form the beam.” *Id.* ¶ 181 (emphasis added). His reply testimony departs from this by stating that, instead, “[b]eamforming *does not require that the geometry of the array be known.*” Ex. 1029 ¶ 11 (emphasis added). *See also id.* ¶¶ 12–21 (opining on methods of “blind beamforming” in which the algorithms need not know the

locations of the microphones). These statements cannot both be true.

Dr. Vipperman's contradictory testimony is not credible and is entitled to no weight.

We also note that, if his second theory is true, and the array geometry need not be known, this would undermine Dr. Vipperman's theory as to why the microphones in CTG System must be "positioned at predetermined locations," as recited in claim 1. In other words, if CTG System performs beamforming, under Dr. Vipperman's Reply theory, using an algorithm that is geometry agnostic, Petitioner has not shown that CTG System teaches "a plurality of microphones of the beamforming microphone array are positioned at predetermined locations," as recited in claim 1. Dr. Vipperman opined that CTG System teaches this aspect because the mixers "would need to know the locations of each of the microphones," Ex. 1002 ¶ 181, which would not be the case under his Reply theory.

To be clear, Dr. Vipperman does not testify that either theory is, in fact, how CTG System operates. Rather, Dr. Vipperman has testified as to two ways in which CTG System might work. As noted above, he did not study or test the system, choosing to rely only on marketing and sales documents, and he does not know how CTG System actually works. As also noted above, the FS-400/800 Sell Sheet (Ex. 1013) on which he primarily relies is of little value in understanding how CTG System actually operates. Thus, Dr. Vipperman has little evidence on which to base his testimony. For this additional reason, Dr. Vipperman's testimony lacks credibility and is entitled to no weight.

In sum, Petitioner bases its arguments almost entirely on statements in marketing/sales documents (primarily FS-400/800 Sell Sheet (Ex. 1013)), along with expert testimony purporting to explain those statements. As

explained above, the marketing statements are vague and high-level, it is unclear whether the author of those statements (if the author can be identified) understood them, and Dr. Vipperman's testimony is contradictory, based on insufficient information, and is entitled to no weight. Upon consideration of the complete record, Petitioner has not shown that CTG System has "a beamforming microphone array that includes beamforming and acoustic echo cancellation, a plurality of microphones of the beamforming microphone array are positioned at predetermined locations," as recited in claim 1.

(3) Claim 1: "a ceiling tile combined with the beamforming microphone array, the ceiling tile being sized and shaped to be mountable in a drop ceiling in place of at least one of a plurality of ceiling tiles included in the drop ceiling"

The parties dispute whether CTG System teaches "a ceiling tile combined with the beamforming microphone array, the ceiling tile being sized and shaped to be mountable in a drop ceiling in place of at least one of a plurality of ceiling tiles included in the drop ceiling," as recited in claim 1. The parties' dispute as to this limitation turns on whether "a ceiling tile" is construed as "one or more ceiling tiles" or "a single tile." As explained in Section II.B.1 above, "a ceiling tile" means "one or more ceiling tiles," and is not limited to a single ceiling tile.

Petitioner contends that CTG Manual describes combining CM-01 ceiling microphones with ceiling tiles and that CM-01 Sell Sheet depicts configuring multiple combined tiles in a room configuration. Pet. 75–77 (citing Ex. 1011, 5, 7; Ex. 1012, 1). Petitioner relies, for example, on the figure reproduced below from CM-01 Sell Sheet:



The above figure is a picture of a conference room with an inset picture of a ceiling speaker. Ex. 1012, 1. White arrows point to microphones in two separate ceiling tiles. Dr. Vipperman testifies that

these ceiling tiles depicted in the above picture are sized and shaped to be mountable in a drop ceiling in place of at least one of a plurality of ceiling tiles included in the drop ceiling. Further, because the mounting directions for the CM-01 microphones instruct a user to drill a hole in a ceiling tile and insert the microphone in the hole, the ceiling tiles combined with the microphones are in my opinion the same size and shape as the rest of the ceiling tiles in the drop ceiling, and once combined, the ceiling tiles could replace any of the other ceiling tiles in the drop ceiling.

Ex. 1002 ¶ 185.

Patent Owner, referring to its claim construction position, argues that CTG System does not teach this limitation because “the ceiling tile that is combined with the BMA is a single ceiling tile. CTG, however, distributes

its microphones among multiple ceiling tiles.” PO Resp. 50–51 (citing Ex. 1012, 1). We do not adopt Patent Owner’s proposed construction that the microphones of the claimed beamforming microphone array must all be in a single tile. Petitioner’s evidence shows that CTG System’s alleged beamforming microphone array is combined with one or more ceiling tiles. On the complete record, we find that CTG System teaches “a ceiling tile combined with the beamforming microphone array, the ceiling tile being sized and shaped to be mountable in a drop ceiling in place of at least one of a plurality of ceiling tiles included in the drop ceiling.”

(4) Claim 1: Conclusion

As explained above, Petitioner has not shown that CTG System or Levitt teaches “a beamforming microphone array that includes beamforming and acoustic echo cancellation, a plurality of microphones of the beamforming microphone array are positioned at predetermined locations,” as recited in claim 1. Accordingly, Petitioner has not shown, by a preponderance of the evidence, that claim 1 would have been obvious over CTG System and Levit.

(5) Claims 2–24

Petitioner incorporates its arguments for claim 1 as to independent claims 9 and 17. Pet. 78–80. Patent Owner does not argue claims 9 and 17 separately. PO Resp. 38–52. Claim 9 recites “providing a beamforming microphone array that includes beamforming and acoustic echo cancellation, a plurality of microphones of the beamforming microphone array are positioned at predetermined locations” and claim 17 recites “picking up audio input signals with a beamforming microphone array that includes

beamforming and acoustic echo cancellation, a plurality of microphones of the beamforming microphone array are positioned at predetermined locations.” For the same reasons as given for claim 1, Petitioner has not shown, by a preponderance of the evidence, that claims 9 and 17 would have been obvious over CTG System and Levit.

Claims 2–8 depend from claim 1; claims 10–16 depend from claim 9; and claims 18–24 depend from claim 17. Petitioner’s remaining arguments (Pet. 80–86) do not cure the deficiency in its showing for claims 1, 9, and 17. Accordingly, Petitioner has not shown, by a preponderance of the evidence, that claims 2–8, 10–16, and 18–24 would have been obvious over CTG System and Levit.

c) Conclusion

On the complete record, Petitioner has not shown, by a preponderance of the evidence, that claims 1–24 would have been obvious over CTG System and Levit.

7. Ground 7: Obviousness of Claims 1–24 over CTG System, Beaucoup, and Levit

Petitioner contends that claims 1–24 would have been obvious over CTG System, Beaucoup, and Levit. Pet. 86–100. As explained below, Petitioner has not made a sufficient showing.

a) Scope and Content of the Prior Art—Overview of Beaucoup

Beaucoup describes a teleconferencing system. Ex. 1017 ¶ 39.

Figure 2, reproduced below, illustrates an example:

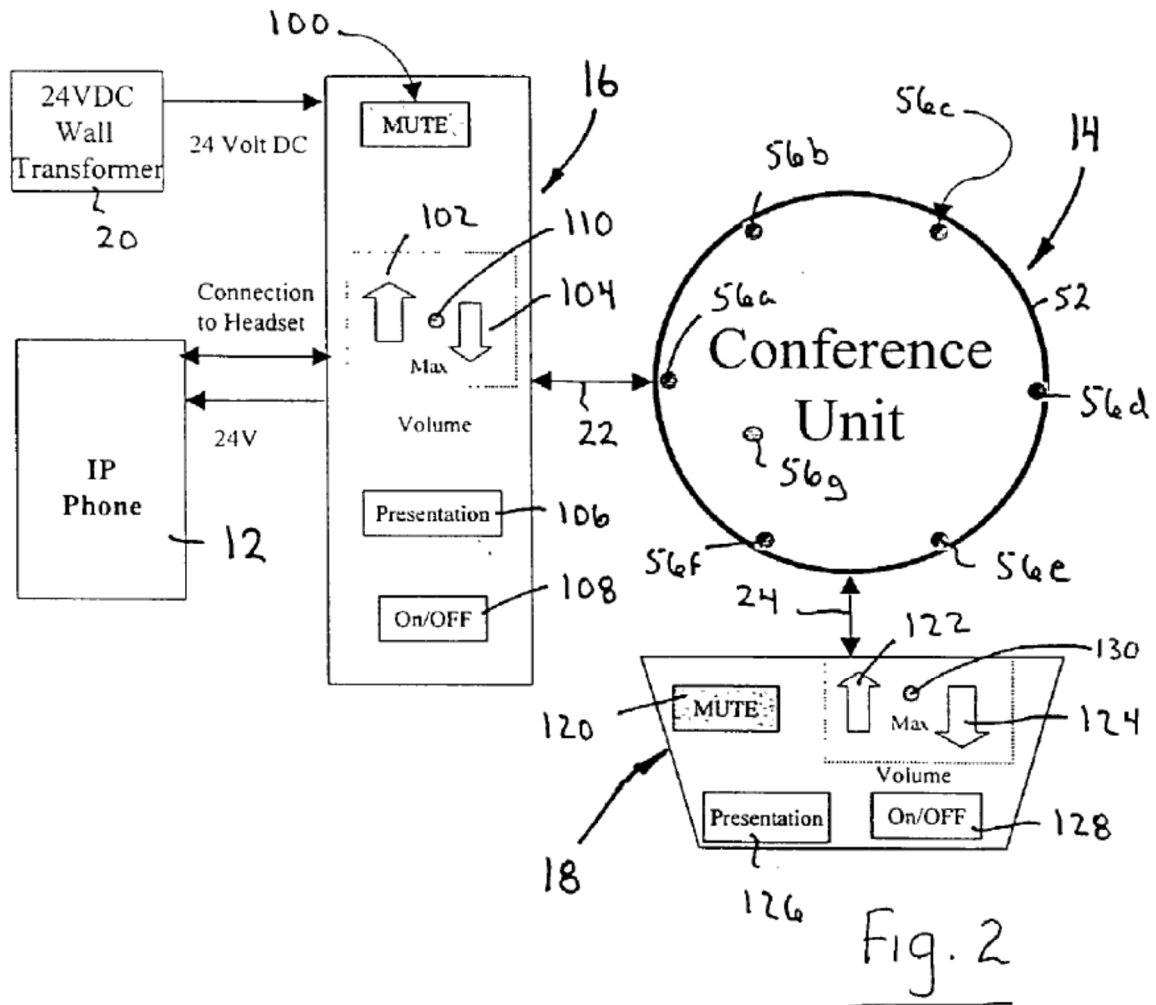


Figure 2 is a schematic block diagram of a teleconferencing system.
Id. ¶ 31. Additional details are shown in Figure 3, reproduced below:

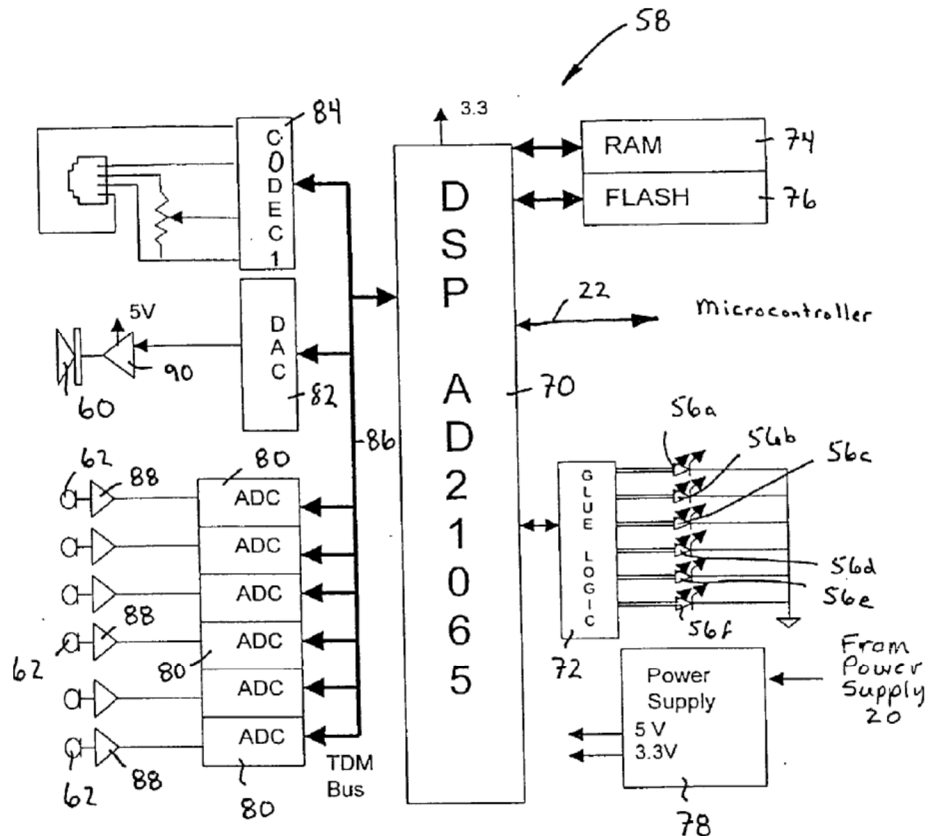


Fig. 3

Figure 3 is a schematic block diagram of a controller for conference unit 14 of Figure 2. *Id.* ¶ 32.

Conference unit 14 includes a partly spherical body 52 with loudspeaker 60 and a steerable, circular microphone array including six equally spaced omni-directional microphones 62 that surround loudspeaker 60 and are positioned within body 52. *Id.* ¶ 41. DSP 70 performs beamforming, beamsteering, and acoustic echo cancellation. *Id.* ¶ 44. “During execution of the beamforming algorithm, the DSP 70 uses the microphones 62 to synthesize one or more narrow acceptance angles or microphone beams,” and “processes audio signals picked up by the microphones 62 to determine the location of the active talker in the

surrounding environment based on the microphone beam that picks up audio signals having the highest energy level.” *Id.* ¶¶ 44–45.

When audio signals are picked up by the microphones 62 and delivered to the DSP 70, the DSP, which executes the beamsteering algorithm, determines the location of the active talker in the surrounding environment. The active talker location is then used by the beam forming algorithm executed by the DSP 70 to steer the omni-directional microphone array towards the talker 150 by synthesizing narrow microphone beams 140 in the talker direction as shown in FIG. 6.

Id. ¶ 52.

b) Differences, if any, between Claims 1–24 and the Combination of CTG System and Levit; Reasons to Modify or Combine

Petitioner argues that “[a person of ordinary skill in the art] would have been motivated to combine the CTG System and Beaucoup to utilize Beaucoup’s DSP for the beamforming, acoustic echo cancellation, and noise cancellation or de-reverberation functionality, and Beaucoup’s arrangement of microphones in a single body.” Pet. 89. Petitioner argues that both CTG System and Beaucoup “disclose[] a device that performs beamforming and acoustic echo cancellation in a teleconferencing environment,” and that both execute algorithms to form a beam aimed at a speaker and follow the speaker as they move about a room. *Id.* at 88–89. According to Petitioner, the skilled artisan “would have recognized this functionality could, efficiently and compactly, be implemented in a beamforming microphone array that includes multiple microphones within the same device.” *Id.* at 90.

Petitioner contends that CTG System teaches “a beamforming microphone array that includes beamforming and acoustic echo cancellation,” “the plurality of microphones of the beamforming microphone

array are positioned at predetermined locations,” and “the beamforming microphone array picks up audio input signals,” and that Beaucoup describes an alternative teaching for each of these limitations. Pet. 91–93. However, the Petition does not suggest that CTG System is missing one of these limitations, does not explain why it is presenting each alternative theory, and does not explain specifically for these limitations why a skilled artisan would have combined or substituted Beaucoup’s teachings for those of CTG System. *Id.*

As to “a ceiling tile combined with the beamforming microphone array, the ceiling tile being sized and shaped to be mountable in a drop ceiling in place of at least one of a plurality of ceiling tiles included in the drop ceiling,” Petitioner argues that, if we conclude that “a ceiling tile” is limited to a single ceiling tile, CTG System in view of Beaucoup teaches this limitation. Pet. 93–94. Petitioner argues that Beaucoup describes a circular microphone array including six equally spaced omni-directional microphones and a controller coupled together, and that the controller includes a DSP for performing beamforming on the audio signals picked up by the microphones. *Id.* at 94 (citing Ex. 1017 ¶¶ 41–42, 44–45, 52).

Petitioner argues:

a [person of ordinary skill in the art] would have been motivated to combine the CTG System with Beaucoup with a reasonable expectation of success so that a plurality of microphones in an array could be combined into a single ceiling tile, similar to how Beaucoup discloses its beamforming microphone array within the body 52 of the conference unit 14. A [person of ordinary skill in the art] would have understood a circular microphone array, including the omni-directional microphones and the DSP, could be installed in a ceiling tile in a similar manner to the omni-directional CM-01 ceiling microphones used in the CTG System.

Id. at 94 (citing Ex. 1002 ¶ 218). Dr. Vipperman essentially repeats these arguments in his testimony. Ex. 1002 ¶ 218.

In the Institution Decision, we found that “Petitioner’s reasons for including Beaucoup are less than clear”, but that “it appears that Petitioner is citing Beaucoup for teachings of (1) beamforming, acoustic echo cancellation, noise cancellation, and de-reverberation functionality; and (2) an arrangement of multiple microphones in a single body.” Dec. 72 (citing Pet. 88–90). Taking into account Petitioner’s argument that a skilled artisan “would have been motivated to combine the CTG System and Beaucoup to utilize Beaucoup’s DSP for the beamforming, acoustic echo cancellation, and noise cancellation or de-reverberation functionality, and Beaucoup’s arrangement of microphones in a single body,” Pet. 89, we observed that “Petitioner appears to argue that, in light of Beaucoup’s teachings, a skilled artisan would have recognized that the algorithms of the FS-400 and FS-800 mixers of CTG System could be ‘implemented in a beamforming microphone array that includes multiple microphones within the same device,’” Dec. 72–73.

Petitioner now argues that we misunderstood the Petition’s allegations and that “the proposed combination is modifying the CTG System to replace each CM-01 microphone with Beaucoup’s conference unit containing the circular microphone array and DSP.” Reply 13–14. Patent Owner complains that this is a new argument not presented in the Petition. Sur-reply 17–19. Patent Owner argues that “the petition is quite unclear regarding the role of Beaucoup in Challenge 7,” and that “[t]he petition never referred to the combination yielding **multiple** [beamforming microphone arrays].” *Id.* at 18–19.

Even if we consider the combination presented in the Reply to be a proper clarification of the challenge in the Petition, Petitioner has not shown that a skilled artisan would have had reasons, with rational underpinning, to make this combination. As to why a skilled artisan would have made this combination, Petitioner offers the following “benefits” of its proposed combination:

- (1) “[e]liminate the need to walk up to a table to be heard in a room with perimeter seating”; (2) “[a]llow furniture to be rearranged without compromising the audio system”;
- (3) “[p]rovide even pickup for the maximum number of participants with the minimum number of microphones”;
- (4) “[c]reate a clean, clutter-free environment without visible cables”; (5) allow the microphones to be “virtually invisible”;
- (6) “[m]inimize unwanted table noise such as paper shuffling, pen clicking, or key strokes”; and (7) “[f]ree participants to turn their backs to the table, walk around, and still be heard evenly.”

Pet. 90 (quoting CTG White Paper (Ex. 1014) (alterations by Petitioner)).

Dr. Vipperman reproduces this list in his testimony, but does not provide any additional explanation as to why or how the combination would provide these benefits. Ex. 1002 ¶ 208.

Patent Owner responds that “none of those alleged benefits relate to the Beaucoup system, let alone the positions of the microphones in Beaucoup,” and instead, “the alleged benefits are from the CTG system itself.” PO Resp. 59. We agree with Patent Owner. Each of Petitioner’s alleged benefits of the combination are stated benefits of CTG System alone, as listed in CTG White Paper. Ex. 1014, 9. Petitioner and Dr. Vipperman provide no meaningful argument or evidence of why each of these benefits of CTG System would be a benefit of the proposed combination, or why a skilled artisan would have modified CTG System with the teachings of Beaucoup to achieve benefits CTG System already touted.

Patent Owner also argues that each of the benefits of CTG System would teach against consolidating microphones according to the teachings of Beaucoup. PO Resp. 59–60. Regarding benefits 1–3 and 7, Patent Owner argues that consolidating the microphones would create, rather than eliminate, a need to walk up to the table to be heard (as the microphones would be clustered rather than distributed); that furniture would need to be tightly packed into a reduced coverage area; that even pickup for a maximum number of participants would be destroyed; and that participants would no longer be able to move around the room and still be heard clearly. *Id.* Regarding alleged benefits 4–6, Patent Owner argues that they “do not relate to the position of the microphones and thus have no bearing on whether a [person of ordinary skill in the art] would have been motivated to consolidate all of the microphones in a single ceiling tile.” *Id.* at 60. Patent Owner also argues that the combination Petitioner advances in the reply (replacing each of CTG System’s microphones with the beamforming microphone array found in Beaucoup) would result in an array of microphone arrays, and that “the petitioner provides no evidence of how that combination would operate.” Sur-reply 21. Patent Owner’s concerns are logical and well-founded and Petitioner does not provide meaningful argument or evidence to address them.

We find that the listing of CTG System’s benefits in CTG White Paper (Ex. 1014, 9) does not provide a reason, with rational underpinning, to combine the teachings of CTG System and Beaucoup.

Petitioner also argues that “[b]oth the CTG System and Beaucoup rely on an omni-directional microphone array and both disclose using beamforming to point a beam in the direction of a talker.” Pet. 88–89 (citing Ex. 1013, 1; Ex. 1017 ¶ 52; Ex. 1002 ¶ 206). Relying on Dr. Vipperman’s

testimony, Petitioner argues that arranging the microphones in a single body would have yielded the predictable results of compactness, ease of installation, and reduction in potential noise. Pet. 89 (citing Ex. 1002 ¶ 207). Dr. Vipperman essentially repeats Petitioner's arguments in his testimony, but does not state the basis for his conclusions. Ex. 1002 ¶ 107. For this reason, that testimony is entitled to little weight. *See* 37 C.F.R. § 42.65(a).

Additionally, Dr. Vipperman's testimony appears to be based on his assumption that CTG System and Beaucoup have similar beamforming algorithms. Ex. 1002 ¶ 207 ("Beaucoup states that its DSP executes a beamforming algorithm 'to steer the omni-directional microphone array towards the talker 150 by synthesizing narrow microphone beams 140 in the talker direction as shown in FIG. 6.' EX1017 ¶ [0052]. A [person of ordinary skill in the art] would have recognized that the FS-400/800 mixers in the CTG System similarly execute an algorithm that effectively forms a beam aimed at the person speaking and follows that person as they move about the room. EX1013, 1. A [person of ordinary skill in the art] would have recognized that this functionality could, efficiently and compactly, be implemented in a beamforming microphone array that includes multiple microphones within the same device."). As explained in Section II.C.6.b)(2) above, Dr. Vipperman's conclusion that CTG System performs beamforming is self-contradictory, unsupported by persuasive evidence, and entitled to no weight. For the same reasons, Dr. Vipperman's testimony that Beaucoup and CTG System have similar beamforming algorithms is not credible.

Moreover, Patent Owner argues, based on Dr. Begault's testimony that CTG System performs gating rather than beamforming, that modifying CTG System to combine the signals from the microphones to form a beam

would drastically change CTG System's principle of operation. PO Resp. 58 (citing Ex. 2013 ¶¶ 48, 56, 58–60, 70–74). Although we do not find that CTG System in fact performs gating rather than beamforming, Dr. Begault's testimony that FS-400/800 Sell Sheet's description is consistent with gating further highlights the deficiency in Petitioner's allegations that CTG System performs beamforming. Since we have no persuasive evidence on which to find that CTG System performs beamforming, we are not persuaded by Petitioner's argument and Dr. Vipperman's testimony that a skilled artisan would have combined the teachings of CTG System and Beaucoup based on alleged similarities in their beamforming algorithms. We find that the alleged similarities in the beamforming algorithms of CTG System and Beaucoup do not provide a reason, with rational underpinning, to combine the teachings of CTG System and Beaucoup.

In the Reply, Petitioner argues that if CTG System performs source tracking rather than beamforming, that Dr. Begault identified several advantages of beamforming over source tracking during cross-examination. Reply 14–15 (citing Ex. 1038, 175:11–176:20). Petitioner does not explain why this generic recitation of benefits relates to a combination of CTG System and Beaucoup. Indeed, Dr. Begault testifies that they would not be applicable to Petitioner's proposed combination. Ex. 1038, 176:21–177:3. Petitioner also argues that Dr. Begault “confirms several reasons why a [person of ordinary skill in the art] would modify the CTG System with Beaucoup as described in the Petition to substitute each of CTG's microphones with Beaucoup's beamforming microphone array.” Reply 14–15 (citing Ex. 1038, 173:14–175:16). In this testimony, Dr. Begault merely confirms that CTG System and Beaucoup are similar in that both discuss using more than one omni-directional microphone in a conference room.

Ex. 1038, 173:14–175:16. We find that Dr. Begault’s cross-examination testimony does not provide a reason, with rational underpinning, to combine the teachings of CTG System and Beaucoup. In any case, as explained above, Petitioner does not establish whether CTG System performs beamforming, gating, source tracking, or any other technique.

In sum, we find that Petitioner has not shown that a person of ordinary skill in the art would have had reasons, with rational underpinning, to combine the teachings of CTG System and Beaucoup.

Finally, Patent Owner argues that Petitioner has failed to show a reasonable expectation of success, because it has not shown that a beamforming microphone array designed for a tabletop would nevertheless work when mounted on a ceiling and at a greater distance from talkers. Reply 21. Petitioner cites to Dr. Vipperman’s testimony to show a reasonable expectation of success. Pet. 94 (citing Ex. 1002 ¶ 218). Dr. Vipperman’s only testimony on the expectation of success for his proposed combination is “[f]or the reasons stated above in [¶¶ 206–208], a [person of ordinary skill in the art] would have been motivated to combine the CTG System with Beaucoup with a reasonable expectation of success so that a plurality of microphones in an array could be combined into a single ceiling tile, similar to how Beaucoup discloses its beamforming microphone array within the body 52 of the conference unit 14.” Ex. 1002 ¶ 218. The earlier testimony to which he refers (Ex. 1002 ¶¶ 206–208) does not meaningfully discuss expectation of success. We find that Petitioner has not shown that a skilled artisan would have had a reasonable expectation of success in combining the teachings of CTG System and Beaucoup.

c) Conclusion

On the complete record, Petitioner has not shown that a skilled artisan would have had reasons, with rational underpinning, for combining the teachings of CTG System and Beaucoup, or that a skilled artisan would have had a reasonable expectation of success in combining those teachings. Therefore, we conclude that Petitioner has not shown, by a preponderance of the evidence, that claims 1–24 would have been obvious over CTG System, Beaucoup, and Levit.

III. PATENT OWNER’S CONTINGENT MOTION TO AMEND

Patent Owner filed a Revised Contingent Motion to Amend (Paper 37). According to that Motion, “[c]laims 25–48 are contingent substitutes for original claims 1–24, respectively. [Patent Owner] asks that each substitute claim be considered (and found patentable) only if its corresponding original claim is found unpatentable.” Paper 37, 1.

For the reasons given above, Petitioner has not shown, by a preponderance of the evidence, that any challenged claim is unpatentable. Because no challenged claim has been determined to be unpatentable, we do not consider whether Patent Owner’s proposed substitute claims are patentable. *See Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 at 3 (PTAB Feb. 25, 2019) (precedential) (“[A] proposed substitute claim normally will be considered only if a preponderance of the evidence establishes that the original patent claim that it replaces is unpatentable.”).

Accordingly, we dismiss Patent Owner’s Contingent Motion to Amend as moot.

IV. PATENT OWNER’S MOTION TO EXCLUDE

Patent Owner files a Motion to Exclude (Paper 50), seeking to exclude all or portions of the following exhibits:

FS-400/800 Sell Sheet (Ex. 1013) (Mot. to Exclude 8–11);

CTG Audio, Introducing the CTG FS-400 and FS-800 With “Beamforming” Technology (Ex. 1027) (Mot. to Exclude 8–11);

Portions of Mr. Newman’s Declaration (Ex. 1009 ¶¶ 6, 7, 10, 13–16, 19) (Mot. to Exclude 3–7);

Portions of Dr. Vipperman’s declarations (Ex. 1002 ¶¶ 135–136, 171–185, 203–237; Ex. 1029 ¶¶ 11–21, 27–46) (Mot. to Exclude 11–15).

For the reasons given above, even if we do consider the evidence Patent Owner seeks to exclude, we still conclude that Petitioner has not shown, by a preponderance of the evidence, that any challenged claim is unpatentable. Thus, we need not reach Patent Owner’s Motion to Exclude.

Accordingly, we dismiss Patent Owner’s Motion to Exclude as moot.

V. CONCLUSION

Petitioner has not shown by a preponderance of the evidence that claims 1–24 are unpatentable. We dismiss Patent Owner’s Motion to Amend and Motion to Exclude as moot.

In summary:

| Claims | 35 U.S.C. § | Reference(s)/ Basis | Claims Shown Unpatentable | Claims Not Shown Unpatentable |
|----------------------------|--------------------|---------------------------------------|--|--|
| 1–24 | 112(b) | Indefiniteness | | 1–24 |
| 1–24 | 112(a) | Enablement | | 1–24 |
| 1–24 | 112(a) | Written description | | 1–24 |
| 1–24 | 112(a)/ 132(a) | Written description/ new matter | | 1–24 |
| 1–24 | 103 | Graham, Levit | | 1–24 |
| 1–24 | 103 | CTG System, Levit | | 1–24 |
| 1–24 | 103 | CTG System, Levit, Beaucoup | | 1–24 |
| Overall Outcome | | | | 1–24 |

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED, based on a preponderance of the evidence, that claims 1–24 have not been shown to be unpatentable;

FURTHER ORDERED, that Patent Owner’s Revised Contingent Motion to Amend (Paper 37) is dismissed as moot;

FURTHER ORDERED, that Patent Owner’s Motion to Exclude (Paper 50) is dismissed as moot; and

FURTHER ORDERED, because this is a final written decision, the parties to this proceeding seeking judicial review of our Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

PGR2020-00079
Patent 10,728,653 B2

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